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BEEF-CATTLE  
PRODUCTION  
IN THE  
RANGE AREA



**T**HE RANGE AREA is generally considered as that part of the United States west of the one-hundredth meridian. Approximately 40 percent of the Nation's beef cattle are produced in this area.

The production of feeder and grass-fat cattle in the range States and the fattening of cattle in the Corn Belt States are closely related. Factors influencing the one generally influence the other.

In the range area the tendency is toward operation on a smaller scale and greater distribution of land ownership. Improvements on ranching land should be practical, economical, and substantial. A relatively high percentage of the investment should be in productive livestock rather than in improvements and equipment that may not increase the income accordingly.

The better range grasses may be increased by deferred or selective grazing. Returns from range improvement and conservation may be expected in the yield of more pounds of beef per acre and a higher market value of the land.

The selection of individuals for the breeding herd is of prime importance. The system of management should be in accordance with requirements of the region, with special regard to climatic conditions. Other practices that are conducive to the production of a high-class product at a minimum cost should predominate.

Ordinarily the higher-priced lands can best be utilized for the production of breeding cattle rather than commercial beef. The use of range bulls locally produced is generally beneficial to producer and user alike.

# BEEF-CATTLE PRODUCTION IN THE RANGE AREA

By VIRGIL V. PARR, *animal husbandman, Animal Husbandry Division, Bureau of Animal Industry*

Revised by E. W. MCCOMAS, *animal husbandman, Animal Husbandry Division*

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## THE RANGE AREA AND ITS SUBDIVISIONS

THE RANGE AREA is that portion of the Western States in which cattle, sheep, and Angora goats are produced largely by utilizing the native grasses, browse, and other forages growing on large areas of land which cannot at this time be economically cultivated. The one-hundredth meridian is ordinarily considered the dividing line, but no single line can be drawn to mark the division between the range and farming areas, as the change is not abrupt. A strip of territory varying in width from 25 to 150 miles extends irregularly in a north and south direction along the one-hundredth meridian, within which there is a general tendency from the east to the west to devote an increasing percentage of the land to pastures and a smaller percentage to crop production. This strip may be considered the practical division between the farming area of the Eastern and the range area of the Western States.

Within the range area the amount of land devoted to grazing has been greatly decreased during the past 30 years. Crop adaptation and improved methods of conserving rainfall have made dry farming possible under climatic conditions which had not previously been considered favorable. Moreover, large areas of grazing and desert land have been made highly productive by irrigation. The amount of feed produced on irrigated land and by dry farming has brought about new methods of beef-cattle production.

The range area (fig. 1) constitutes approximately 45 percent of the total land area of the United States and may be divided into four parts: The Great Plains, Rocky Mountain, Intermountain, and Pacific coast regions. Each of these divisions is characterized by

a different type of range and prevailing method of beef-cattle production. Each presents individual problems of beef-cattle production, as well as sharing in problems common to the whole area. While certain practices may be advocated that will apply to the entire range area, others may be applicable to local conditions in

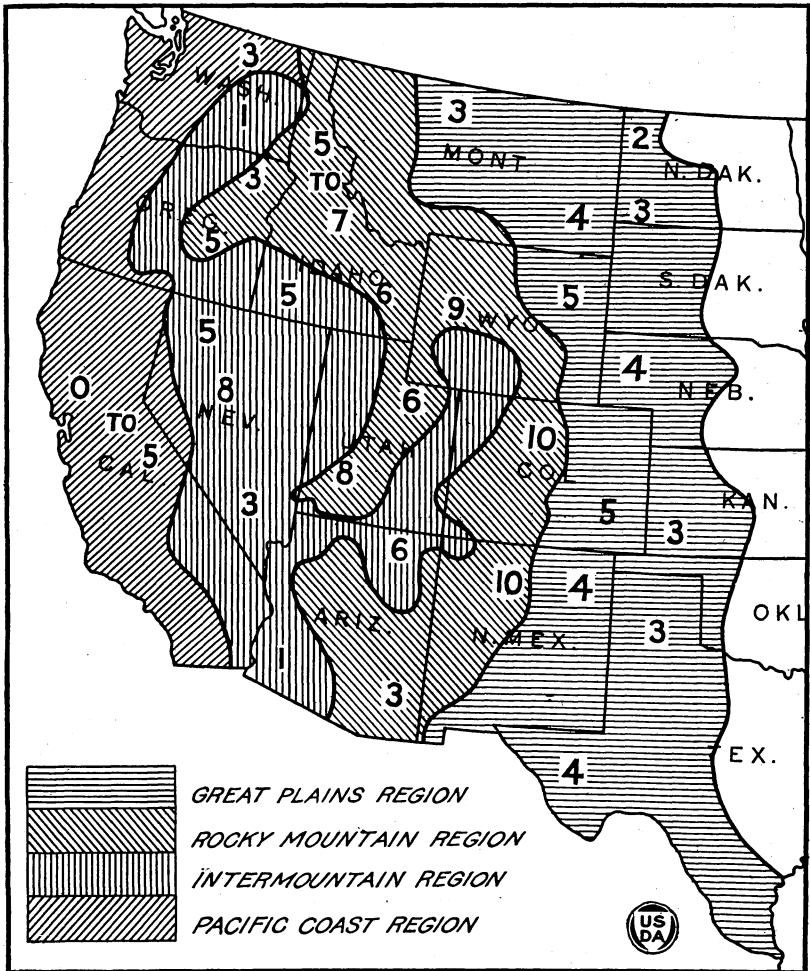


FIGURE 1.—Range area showing the respective regions of beef-cattle production based on the general methods of range utilization. (Numerals represent approximate altitude of the section in thousands of feet, as compiled by the Geological Survey.)

one section and utterly impracticable in other localities within the same district.

#### THE GREAT PLAINS REGION

The Great Plains region constitutes the eastern portion of the range area, and its western boundary is formed by the foothills of the Rocky Mountains. The topography varies from the rough, broken, choppy surface which characterizes the Badlands of South

Dakota to the level, timberless plains, typified by the Staked Plains of western Texas and eastern New Mexico. Between these two extremes are areas of comparatively smooth, rolling hills and other areas more or less broken and covered with shrubs or small brush. The Great Plains may be termed the "pasture region", because a high percentage of all grazing lands is under fence. That portion formerly called the open range, was of practical use only in connection with privately controlled lands, as the grazing value was comparatively low on account of the homesteading of the more desirable sections and the subsequent overstocking of the remaining areas. The comparatively small amount of forest range in this region is utilized principally in connection with privately owned lands.

The size of the cattle establishments in this region varies, and producers may be grouped in two classes, (1) those who derive most of their income from farming operations and produce only a few cattle and (2) those who depend on cattle for the greater portion of their income and confine their farming activities largely to the production of necessary feed for cattle. Individuals or concerns of the second class operate over a larger acreage than the first, and such ranching properties occasionally consist of 100,000 acres or more. Operation on less than 2,000 acres in this region very often necessitates a major emphasis on crop production, as the income from such a small acreage devoted to cattle raising is not adequate for necessary improvements and the support of a family.

On the whole the Great Plains region is one of yearlong grazing; but from the Panhandle of Texas northward heavy snows cover some of the ranges for limited periods, interrupting winter grazing and necessitating feeding to prevent or reduce losses. It is also customary among many of the northern producers to supply feed in connection with winter grazing, especially when the range is short through overstocking or failure of the normal amount of summer and fall rains. The southern portion of the region has more nearly yearlong grazing, owing to a lack of snowfall. However, feed is often supplied during periods of range shortage, both in the summer and winter, especially during the long droughts that are more or less periodic. It is the policy of stockmen throughout the region to utilize native pastures, so far as possible, during the entire year and thus avoid the expense of supplying hay or cottonseed cake, which are the principal supplemental feeds. In certain sections of the southern portion the sweet and grain sorghums and Johnson grass are used extensively as roughage. The grain from kafir, milo, hegari, and feterita is becoming more extensively used for fattening.

Wide variations in climatic conditions other than rainfall occur in this region. The summers in the northern portion are usually cool; but in the southern portion the dry, hot winds often cause high surface evaporation, which is detrimental to the proper growth of range grasses and crop production. Climatological studies indicate that 20 inches of rainfall in the northern is equivalent to 30 inches of rainfall in the southern Great Plains, owing to the high surface evaporation in the latter. Seventy percent of the annual precipitation occurs between April 1 and September 30. This fact is especially worthy of notice, because a dry fall permits the curing of the native grasses on the range into a very desirable quality of feed.

## THE ROCKY MOUNTAIN REGION

The Rocky Mountain region comprises the principal ranges of mountains that make up the Rocky Mountain system, their adjacent spurs, and the intervening areas of farming and grazing land of lower altitude than the mountains proper. The topography of the region varies from the more or less level valleys to the rugged areas found at different altitudes. In many instances the foothills are smooth and rolling and support growths of sagebrush or other shrubs of varying density, while in the higher elevations timber abounds, except in the extremely high altitudes. Practically the entire region, as shown in figure 1, is national-forest range; but in addition there are small areas of vacant public lands. Some of these areas are being utilized in connection with the forest range and privately owned lands for farming and grazing in accordance with the amount of acreage adapted to each purpose. Adjustments are being made with the General Land Office, United States Department of the Interior, to facilitate the consolidation of holdings.

The national-forest range of this region, with the exception of areas in New Mexico and Arizona that are utilized for winter grazing, is used for summer grazing only. The foothills and open ranges are grazed during the winter as climate and forage conditions permit, but much dependence is placed on privately owned pasture and farming lands for wintering purposes. The cropland is of the utmost importance in supplying the winter feed, which is generally some variety of hay.

The winters are often severe and, in the central and northern portions of this region, are accompanied by heavy snowfall. Usually the winters are milder in the southern portion. During seasons of severe winter storms, heavy feeding is the means used to prevent excessive losses. In the higher altitudes a relatively high percentage of the annual precipitation is in the form of snow, which furnishes water, where conserved, for irrigation in the spring and summer.

## THE INTERMOUNTAIN REGION

The Intermountain region comprises the vast area of range lands lying between the Rocky Mountain and Pacific coast regions. The topography varies from mesas or gently inclining plains of variable area that occur throughout the region, but notably in Arizona, to the broken and rolling areas common in Nevada and southeastern Oregon. The characteristic range is semiarid or arid and more or less covered with sagebrush. A very large proportion of the open range, or the public land, lies within this region.

Formerly, these lands were referred to as unappropriated and unreserved public domain, or simply as public domain, but they were temporarily withdrawn from entry and reserved by executive orders issued in 1933 and 1934. Since Congress enacted legislation in 1934 known as the Taylor Grazing Act, free and unrestricted use of these lands has not been permitted, but specific areas designated as grazing districts by the Division of Grazing, United States Department of the Interior, are administered under a leasing system.

The national-forest acreage is small as compared with that of the Rocky Mountain region, and forms an inconsiderable percentage

of the total grazing lands within the Intermountain region. In addition to the utilization of the reserved and forest range, there are throughout the region companies and individuals that operate on an extensive scale on privately owned lands. In most sections accessibility to water is the chief factor in determining the extent of operations and size of herd.

The national-forest range in this region is used for summer grazing. Some of the reserved public land is grazed throughout the year. Areas that do not have a sufficient water supply to permit their use during the summer are often used for winter ranges. The vegetation also has much to do with the utilization of a range for wintering purposes. Areas of low rainfall, 5 inches or less, are located in southeastern California and southwestern Arizona. In other sections of this region there are areas of variable size which have such scant vegetation or are so lacking in water for the stock as to render them worthless for grazing purposes during any season of the year. Practically all privately owned lands are under fence and in general are utilized for wintering purposes or holding pastures at various seasons of the year, particularly for weaning or caring for the weaker cattle.

A small portion of the privately owned land is devoted to farming, which is often limited to the production of hay for feed. Alfalfa hay is more commonly produced on the irrigated land and native-grass hays in the moist valleys. In the northern portion of this region grain-farming areas lie in such proximity to the ranges that the stubble fields may be grazed during the fall and early winter. Particularly is this practiced among grain farmers who produce some cattle. Grain crops that fail to mature are commonly converted into hay and utilized as feed.

In the northern portion of this region from 30 to 40 percent of the annual precipitation occurs between April 1 and September 30, and in the southern portion, from 40 to 50 percent. Snows are often heavy enough in the northern portion to interfere seriously with grazing even in the lower elevations, and during such times extra attention must be given to cattle that are wintering out. In the southern portion the snowfall is very light except in the higher altitudes, where it is usually of only a few days' duration. It has little effect other than to interrupt grazing, which is many times repaid by the moisture stored.

#### THE PACIFIC COAST REGION

The Pacific coast region comprises the western and northern three-fifths of Washington, the western third of Oregon, and practically all of California except those portions in the northeastern and southeastern parts included in the Intermountain region. The important mountain ranges are the Okanogan highlands of northern Washington, the Cascade Mountains, and Sierra Nevada that extend in a general northerly and southerly direction across Washington and Oregon, and the northern two-thirds of California. The coast ranges are of less importance. The topography varies from almost level valleys to the rougher sections within the mountain areas. Areas of foothills more or less rolling in nature furnish a large percentage of the yearlong range.



Range conditions in the Pacific coast region are very similar to those in the Rocky Mountain region in that a large part of the grazing land is national forest and is utilized for summer grazing. In addition there are areas of reserved public land which are of some value for grazing, but scarcity of water and rough and broken ground are characteristic of the remaining small areas of public lands. Privately owned lands are generally confined to the valleys and foothills. Valley land is of especial importance in connection with grazing land in private ownership or forest range, since feed production for wintering purposes is an important limiting factor in cattle production. Because of climatic conditions this region probably offers a wider variety of feed production than any of the other regions of the West; but, on the whole, more reliance is placed on hay crops and alfalfa in the irrigated sections, on timothy and clover in the higher elevations, on native grasses in the moist valleys, and on grain hay and straw in those sections where grain is produced. There are other specialized crops that contribute winter feed. Grain and beet-sugar byproducts are used for fattening purposes.

The Great Plains is a region of summer rainfall, while the Pacific coast is one of winter rainfall. In the northern portion of the Pacific coast region only from 20 to 30 percent of the annual precipitation occurs between April 1 and September 30, while in the southern portion the amount received between those dates does not exceed 20 percent of the total. For this reason there is often scant range on the lower elevations during the summer, while the excessive rains in the winter reduce the feed value of native grasses for winter grazing. Snowfalls occur in the higher altitudes, but the climate is comparatively mild west of the mountains, especially where coastal influences prevail.

In each of the four regions feed production is a matter of the utmost importance, and the tendency is toward a higher percentage of cultivated land, especially where there is an abundance of summer range and the quantity of feed that can be produced is the factor that determines the size of the herd. The opening up of irrigation projects is increasing feed supplies for both wintering and fattening cattle and sheep.

#### NATIONAL-FOREST AND PUBLIC-LAND AREAS

The forest and public lands shown in table 1 are administered by the Forest Service, United States Department of Agriculture, and the General Land Office and the Division of Grazing, United States Department of the Interior, respectively. Grazing privileges are controlled on public lands, as in the case of forest lands. A total of 8,296,735 head of livestock were grazed on public land supervised by the Division of Grazing in 1935. This total included 1,576,976 cattle, 145,735 horses, 6,401,525 sheep, and 172,481 goats. The grazing allowance on the national forests for 1935 totaled approximately 12,000,000 head of livestock. Fees were paid for 1,315,233 cattle, exclusive of calves, and 5,691,086 head of sheep and goats, exclusive of lambs and kids.<sup>1</sup> Forest rangers supervise grazing in addition to discharging other duties.

<sup>1</sup> Numbers of livestock supplied by the Forest Service.

In addition to the forest and public lands shown in table 1 are Indian lands approximating 50,000,000 acres. Indian lands are administered by the Department of the Interior and are classified as agricultural and grazing lands. In many instances leases are obtained by cattlemen for grazing purposes. Some Indians also

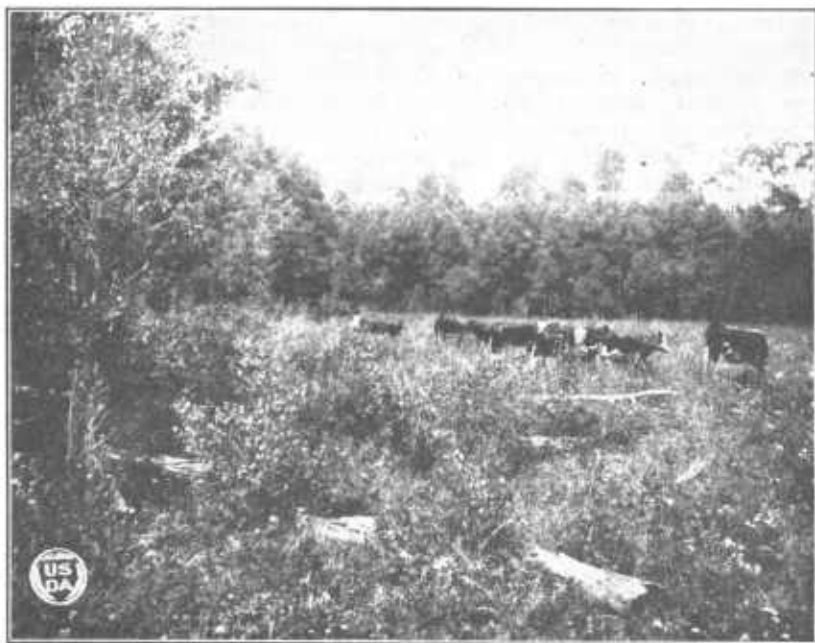


FIGURE 2.—Cattle on Gunnison National Forest range, Colorado.

are engaged in cattle production as individuals or have an interest in the tribal herd.

TABLE 1.—*Acreage of Federal Government lands in Western States, June 30, 1936*

State	National-forest net area <sup>1</sup>	Public land <sup>2</sup>	State	National-forest net area <sup>1</sup>	Public land <sup>2</sup>
Arizona.....	11,389,357	16,929,888	North Dakota.....		179,027
California.....	19,202,647	20,597,339	Oklahoma.....	195,200	11,236
Colorado.....	13,536,000	7,932,036	Oregon.....	13,701,834	15,803,267
Idaho.....	19,747,656	12,427,921	South Dakota.....	1,067,745	499,562
Kansas.....		1,348	Utah.....	7,570,871	26,569,773
Montana.....	16,187,260	7,276,258	Washington.....	9,624,918	1,454,958
Nebraska.....	206,026	33,230	Wyoming.....	8,611,997	16,762,929
Nevada.....	4,985,848	55,952,199			
New Mexico.....	8,542,328	16,552,126	Total.....	134,569,687	198,983,097

<sup>1</sup>Excluding national parks and monuments and nontaxable Indian land.

<sup>2</sup>From National Forest Areas, Misc. O-10, Forest Service, U. S. Department of Agriculture.

<sup>3</sup>Supplied by the General Land Office, U. S. Department of Interior.

In issuing permits for grazing on the national forests preference is given to owners of improved ranching or farming property in the vicinity of the forest. The length of the grazing season varies

within a forest district according to the time of snowfall and the duration of the snow cover in the spring. From 5 to 7 months is the usual length of the cattle-grazing season; but on some southwestern forests yearlong permits are issued. The grazing fees for cattle average 13.05 cents per head per month, and those for sheep 3.36 cents per head per month, with all natural offspring under 6 months of age free of charge. Ten-year permits for grazing are available.

Investigations have been conducted long enough to bring about material changes in the methods of handling cattle on many national-forest ranges. Many of these changes, made on the insistence of the Forest Service, are now considered by many cattlemen as established practices. Most of the changes have been brought about by selecting the best features of the methods followed by the more progressive stockmen and building improved practices on these.

#### NATIVE WESTERN FORAGE PLANTS

Many kinds of grasses grow in the range area; some of these are widespread and others confined to certain localities. Weeds and browse plants also contribute largely to the grazing value of a range. Some varieties of grasses are adapted to certain conditions only and are found more abundantly where these conditions prevail. Examples are the mesquite grass of Texas; the grama grass of western Texas, New Mexico, and Arizona; the buffalo grass and wheatgrass of the more northern Great Plains States; and the bunch grass of Oregon and Washington.

Some of the important forage plants on the western ranges are included in the following list, submitted by the Forest Service:

GRASSES: Wheatgrass, (*Agropyron*), redtop, (*Agrostis*), grama (*Bouteloua*), bromegrass (*Bromus*), buffalo grass (*Bulbils*), reedgrass (*Calamagrostis*), fescue (*Festuca*), junegrass (*Koeleria*), timothy (*Phleum*), bluegrass (*Poa*), dropseed (*Sporobolus*), and curly mesquite (*Hilaria*).

WEEDS (or herb flowering plants): Yarrow (*Achillea*), sheep dandelion (*Agoseris*), fireweed (*Chamaenerion*), alfalfa (*Erodium*), crane's-bill (*Geranium*), lupine (*Lupinus*), bluebells (*Mertensia*), butterweed (*Senecio*), clover (*Trifolium*), vetch (*Vicia*), hawkweed and woollyweed (*Hieracium*), and love-root (*Ligusticum*).

BROWSE: Serviceberry (*Amelanchier*), sagebrush (*Artemisio*), soapbloom (*Ceanothus*), mountain-mahogany (*Cercocarpus*), bitterbrush (*Purshia*), oak (*Quercus*), willow (*Salix*), snowberry (*Symphoricarpos*), pricklypear (*Opuntia*), and mesquite (*Prosopis*).

#### NUMBER OF BEEF CATTLE IN THE RANGE AREA

Table 2, compiled from data from the 1935 census, shows the total number of cattle in the range area, including cows which the census reported under the classification "cows milked." State totals are shown in each of the 11 Western States, while half of the number reported in each of the 6 States lying along the one-hundredth meridian are shown because many cattle are produced in the eastern portion of those States under farming rather than range conditions. In some instances, the estimates of one-half may be high, but for purposes of the present discussion, this method is considered satisfactory, particularly since any separation of the livestock population in these States is purely an arbitrary one.

TABLE 2.—Cattle in the range area, Jan. 1, 1935

State	All cattle <sup>1</sup>	Cows and heifers 2 years old and over, excluding cows milked	All calves under 1 year old <sup>2</sup>	All heifers 1 year old and under 2 years <sup>3</sup>	Steers and bulls 1 year old and over
Arizona.....	770,711	354,812	179,999	95,954	97,437
California.....	2,131,799	494,536	373,021	305,969	362,909
Colorado.....	1,589,509	503,916	459,220	196,935	171,692
Idaho.....	784,272	175,737	205,286	108,546	95,914
Montana.....	1,530,015	547,564	436,840	192,705	175,331
Nevada.....	342,213	138,617	83,135	44,689	56,045
New Mexico.....	1,070,738	509,481	271,734	131,937	85,504
Oregon.....	927,977	236,869	226,549	116,107	97,879
Utah.....	411,107	110,650	101,819	59,099	38,481
Washington.....	740,812	101,394	170,372	100,580	56,957
Wyoming.....	858,006	348,235	270,202	97,520	71,820
Western Kansas.....	1,693,040	339,493	504,383	184,789	224,105
Western Nebraska.....	1,615,800	388,489	500,533	166,506	188,160
Western North Dakota.....	609,292	69,849	143,933	64,381	46,453
Western Oklahoma.....	1,316,195	276,532	372,390	162,287	125,926
Western South Dakota.....	816,138	167,490	221,309	92,799	77,812
Western Texas.....	3,611,185	1,307,221	885,103	397,506	411,344
Total.....	20,818,809	6,070,905	5,405,828	2,518,309	2,383,769

<sup>1</sup> Includes cows milked.<sup>2</sup> Includes calves from cows milked.<sup>3</sup> Includes heifers from cows milked.

This range area and the scattered farming section included within its boundaries were supporting 30 percent of all cattle in the United States and 34 percent of all steers and bulls 1 year old and over on January 1, 1935. The vast amount of land that must be used for grazing rather than for farming adds importance to range livestock production.

The more easterly States, especially those in the Corn Belt, depend greatly on the western producers for their supply of feeder cattle and lambs. The production of feeder cattle in the range States and the finishing of cattle in the Corn Belt are closely related. If, during a period of years, producers in the range area cannot produce and deliver feeder cattle cheaply, Corn Belt feeders cannot expect a plentiful supply of desirable feeder cattle at low prices.

#### CHOICE AND IMPROVEMENT OF RANCHING PROPERTY

The present tendency in the range area is toward smaller-scale operation and toward a greater distribution of land ownership through homesteading, sale of portions of their holdings by large concerns, action of inheritance laws, the sale of State-owned lands, and the development of irrigation projects. In the northern Great Plains area ranchmen are tending to add to their present holdings by acquiring abandoned homesteads. An established ranchman usually faces fewer problems than does one who expects to acquire unimproved land and improve it.

In the acquisition of any land the quality of the range and the possibility of improving it should be considered. The water supply or possibility of its development is of primary importance. Next in importance is the amount of land that can be devoted to farming for feed production, if feed production is essential in that locality.

Small tracts of land, such as from one to three sections, will necessitate the use of other range for a part of the year's grazing if cattle are to be the principal product, unless the quality of the range and farming facilities are such that the property can be utilized or developed as a general livestock farm. Locations near national forests, and in some instances reserved range, are especially desirable.

Privately owned range is preferable in most cases, but cannot always be acquired readily and operated profitably. In certain areas of the Intermountain region, where it is necessary to develop a water supply, it is questionable whether a producer can afford to own more than his hay land. Eagerness to obtain the greatest possible benefits from the open range has resulted in the depletion of many areas by



FIGURE 3.—Stacking timothy and clover hay for winter feeding in southwestern Colorado. The use of modern machinery facilitates the handling of the hay crop.

overstocking. Conservation of certain areas for wintering or other purposes did not, however, always insure the use of the areas by those who conserved it, because other producers sometimes drove their livestock onto the range to take advantage of the better grazing conditions.

Recognition of the importance of the western range is observed in the official policy of exchanging odd parcels of public land for unfavorably located private holdings in the interest of better range management; of selling isolated tracts of public land to stockmen owning adjacent property; of replacing the former practice of indiscriminate use of public grazing land which has lowered its carrying capacity by a policy of controlling grazing on these areas so as to render them more productive.

#### FENCING

All privately owned or leased land should be fenced in order that it may be utilized completely. Fencing need not involve excessive expense. For holding cattle four barbed wires are sufficient, and

in many localities ranchmen construct satisfactory fences of three wires only. In the Southwest, where the screwworm is a serious menace, smooth wire, though infrequently used by ranchmen, is preferred to barbed wire, which cuts the animals and increases the number of cases of screwworms. To keep out hogs, sheep, or goats, woven wire from 26 to 30 inches high with three barbed wires above it makes a good fence, especially for enclosing cultivated lands. Woven wire from 3½ to 4 feet in height with one barbed wire above it makes a very desirable fence, but the cost of wire of that height usually prohibits its use in large quantities, except where sheep or goats are being produced under the pasture system of operation.

It should be kept in mind that the life of the fence depends to a great extent on the stability of the corner posts, and for this purpose extra-large posts set from 3 to 4 feet in the ground and well-braced should be used. It is usually advisable to brace several posts in each direction from a corner, and fence lines several hundred yards or more in length should be braced with heavy posts at such intervals as to prevent slackness of the wires. Intermediate posts should be long enough to be set in the ground from 1½ to 2 feet with 5½ feet above the ground, which will ordinarily permit use a second time if the post becomes broken several inches below the surface of the ground. Posts are usually set from 15 to 20 feet apart, but in sections where timber is expensive or difficult to obtain the distance may be as much as 25 feet. In the latter case, two small staves that will assure proper spacing of the wire should be placed between posts and the wire stapled to them.

In constructing a fence on rough land care should be taken in stretching the wire over hilltops to avoid lifting the posts out of the ground in the low areas. It is usually advisable to make a number of short pulls with the wire stretchers rather than one long pull. In level areas longer pulls may be made from a well-braced post. An effective height for a four-wire fence is 56 inches. The bottom wire may be 18 inches from the ground and a 12-inch space allowed between the first and second and second and third wires; the top wire may be 14 inches above the third. Variation may be made, of course, to suit the condition, as for instance, a pasture to hold calves away from their dams at weaning time demands closer spacing. An ordinary spool of barbed wire weighing 100 pounds contains approximately 440 yards, and in constructing 1 mile of four-wire fence 16 spools of wire are the usual requirement.

Gateposts should be large and set well in the ground. In many instances gateposts are cut long enough so that 10 feet or more will be above the ground, and a wire is stretched from the top of one post to the top of the other. This braces the posts well and is of special importance when a heavy gate is to be hung to one of the posts. Gates are usually made of 1- by 6-inch material. Some ranchmen, however, prefer wire gaps to gates, especially in areas where high winds prevail.

#### THE WATER SUPPLY AND DEVELOPMENT

Hundreds of thousands of acres of grazing land could be utilized more advantageously if sufficient water could be obtained. Reservoirs, springs, wells, and streams are the usual sources of supply.

Wells are usually expensive. The amount of water which they supply does not always justify the expense of boring and furnishing power. Windmills are used extensively in the southern portion of the Great Plains and Intermountain regions; when kept in repair, they are ordinarily the cheapest source of power (fig. 4).

In some instances gasoline engines are installed in addition to windmills as an extra source of power. Springs should be fenced and the water piped to troughs, or first to storage tanks if the supply is small. In sections where sand blows badly, the springs should be cleaned out occasionally to permit the normal flow of water. Weak springs or seeps may be strengthened by digging them out, curbing, and enclosing them. Troughs should be constructed of either concrete, sheet metal, or heavy lumber and should be of such size as to hold sufficient water at all times.



FIGURE 4.—A unit in the water supply on a ranch in southern New Mexico. Water is piped from the dirt tank in the background to the trough in the foreground. A gas engine supplies power in emergencies.

Dirt tanks may be built to conserve rainfall, melting snow, or water from springs. A dirt tank should be so located as to receive the water from an area sufficiently large to supply the requirements. Diversion ditches may be constructed, usually at small additional expense, to drain into the reservoir from areas that would otherwise drain into other channels. The soil also should be considered, and excavation made to a fine clay or adobe. Sandy and gravel-bottomed tanks are likely to have excessive percolation, but after a time may become coated with silt or finer-textured soil which is less pervious to water. The dam should be high enough to prevent water from flowing over the top and broad enough to withstand the force of the water. The use of concrete in the construction of a dam should be governed by the cost. Dams constructed of dirt are less expensive in the first cost, but should be protected by fencing to prevent wearing away by livestock trails. It is advisable in many instances to put a drain pipe through the dam when it is being constructed, place

the troughs (fig. 5) below the dam, and control the water supply for the troughs by float valves. The entire tank may be fenced and pollution of the water minimized. Shallow tanks with large water surfaces exposed are undesirable in areas of high surface evaporation, and deep tanks with extremely steep banks may be the cause of losses of cattle if not fenced. The wasteway should be large enough to permit floodwaters to pass out rapidly. Streams need little attention other than seeing that access to the water is easy and that the number of drinking places is sufficient to accommodate all the cattle. Attention should be given to streams containing quicksand or bogs, and, if practicable, these spots should not be used for watering places.

While it is detrimental to cattle to force them to travel long distances to water, in many of the poorer range sections it is question-

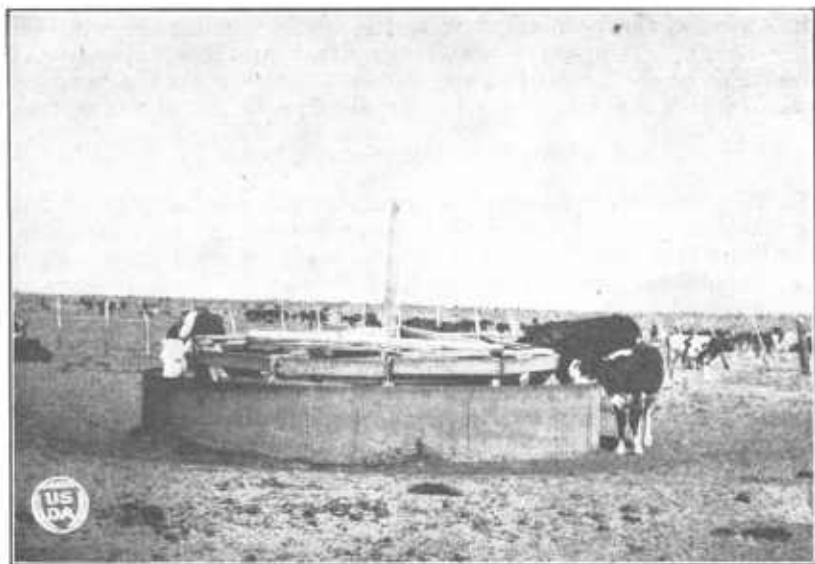


FIGURE 5.—Water is piped from a dirt tank to a watering trough. The supply is regulated by a float valve. The framework prevents livestock from getting into the tank.

able whether the use of the range would justify the cost of developing a water supply.

Careful observations indicate that stock do not always go to water every day. The cooler or wetter it is, the less likely they are to go to water more often than every second or third day. In dry, hot weather, many of them go every day; but others go only twice every 3 days, or once every other day.

Investigations on the Jornada Range Reserve, Las Cruces, N. Mex., indicate that watering places should not be more than 5 miles apart in level country for the best interest of the range and stock. Where the distance is greater, there is uneven utilization of the range beyond  $2\frac{1}{2}$  miles from water and overgrazing near the water. On unfenced range in that locality where watering places were from 7 to 11 miles apart, it was observed that a greater part of the vegeta-



tion was killed within the 1-mile limit of water and that within the 2-mile limit the vegetation was about 50 percent of what it once was and contained a large number of poor forage plants. In the second 2 miles from water the condition of the range was about 73 percent of what could be expected, and beyond the 4-mile limit the range was in about normal condition until drought and continued overstocking materially reduced the forage.

The development of an abundant supply of water is not always desirable or practicable on account of the low carrying capacity of the range. Observations on the Jornada Range Reserve indicate that there should be one watering place for each 500 head of cattle and that it should be large enough to furnish a sufficient amount of water during the most critical times. These watering places may be supplemented with temporary watering places, such as dirt tanks where feasible, to secure better distribution of the stock and relieve the range around the permanent watering places during the wet season of the year. Temporary watering places are less expensive, but should not be constructed as a complete substitute for the permanent system, which may involve a longer distance to travel for water.

#### PROTECTION DURING THE WINTER

In all sections of the respective regions the advisability of building sheds or barns depends to a great extent on the usual winter conditions and other uses that can be made of such improvements. In the southern areas conditions that necessitate sheds or barns are very unusual, and natural protection is afforded by timber and "breaks" (areas of broken terrain). In the northern portions of the range areas, where extremely low temperatures, blizzards, and heavy snows occur, windbreaks or sheds are of practical value. Extremely large herds may be more economically cared for by the building of windbreaks in the absence of sufficient natural protection. A solid wall 7 feet high built of 1- by 12-inch rough boards has proved satisfactory. Posts used in such a windbreak should be large, set at least  $2\frac{1}{2}$  feet in the ground, and 7 or 8 feet apart, depending on whether 14-foot or 16-foot 2 by 4 scantlings are to be used for the crosspieces. Such windbreaks may be built along the north and west sides of corrals where the ground has sufficient slope to insure proper drainage; otherwise, shallow ditches should be constructed.

Sheds with an open side facing in the opposite direction from which storms and blizzards usually come are generally sufficient for protection where corrals are used during part of the winter. Such sheds protect against the wind and save feed. Calves, in particular, should receive protection from the extreme cold. Where cattle are wintered in large numbers and are on pasture most of the time, it is questionable whether furnishing shelter is justifiable, owing to the expense of construction. Expensive barns are not practical for grade cattle. In no event should shelter be constructed for grade cattle without considering the cost of space necessary for each animal, the insurance against loss from blizzards, the saving of feed, and other purposes for which the barn can be used. Under the usual ranching conditions it may be well to reserve, if possible, the pasture or range that offers the best natural protection during

the winter, provided the grass of that particular range is suitable for winter grazing.

For wintering purebred cattle, especially in the northern portions of each region, it is advisable to construct barns that furnish sufficient shelter at the most economical cost per animal to be sheltered. Several other points should be considered in the construction of beef-cattle barns, the most important of which are ventilation and an interior arrangement which facilitates the easy handling of cattle. In barns of this class there should be several box stalls, especially for cows that calve in winter. The location of box stalls should be on the south side, so that the maximum amount of warmth and sunlight can be provided. Stalls for bulls should be built of extra-heavy material. In the southern sections closed sheds costing less than the barns required in the North may be very satisfactory for sheltering purebred cattle.

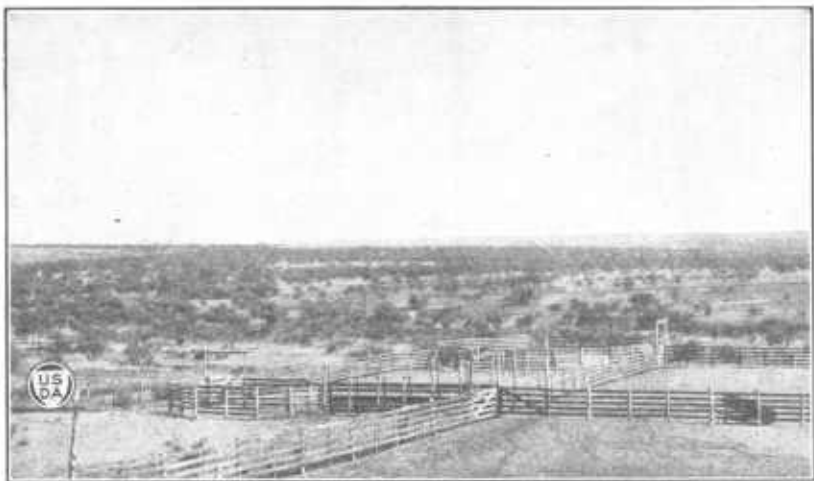


FIGURE 6.—Partial view of a comparatively large system of corrals in the range area.

#### CORRALS

Corrals (fig. 6) are necessary where large numbers of cattle are handled, but small operators can use pens. Corrals should be located where they are accessible to the range, and if practicable should contain a water supply. Wire is not generally used for corrals, because there is much more danger of cattle attempting to break through wire than through board or pole fences. Good fences may be constructed of 1- by 6-inch by 14-foot rough lumber, or 2 by 6's of the same length may be used if the added expense can be afforded. A fence five boards high, properly spaced, with heavy, straight posts set at least  $2\frac{1}{2}$  feet in the ground and  $4\frac{2}{3}$  or 7 feet apart in order that joints may be broken, is very satisfactory. Good corrals may be constructed of split rails or poles where such timber is available. Posts may be set 2 feet in the ground, 6 inches apart, opposite each other and the respective pairs close enough together to hold both ends of the poles or rails as they are laid between the posts. The

tops of the posts may be tied securely with wire.. The construction should not allow any ends to protrude. Adobe or rock walls are rather expensive to construct but are substantial and satisfactory. Subdivisions should be so arranged that cattle can be handled conveniently with the least possible disturbance.

A cutting chute with a swinging gate through which cattle may be driven to separate one class from another by diverting each into a different pen is a great convenience. The saving in handling cattle more quietly and with less labor ordinarily pays in one or two seasons for building such a chute.

In connection with corrals a chute for branding and vaccinating (fig. 7) is usually a profitable investment. A properly constructed branding chute insures ease of handling aged cattle, and eliminates

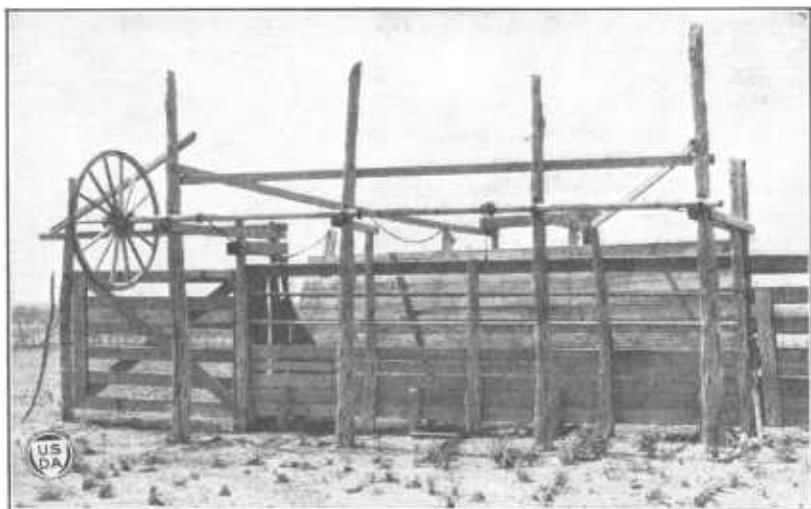


FIGURE 7.—A well-constructed branding chute reduces labor and lessens injury to cattle.

throwing, which occasionally results in injury, especially to cows heavy with calf. Small pens may be used for holding calves, thus reducing running and possible injury from roping. The well-built chute may also be used in dehorning by the addition of a suitable gate. It is best to dehorn cattle when they are young. Dehorning breeding cattle is not considered advisable in some sections of the range area, because they use their horns for defense against predatory animals. Steers should be dehorned, as it usually increases their value in the feeder markets as much as 50 cents per 100 pounds.

In sections where cattle are often infested with ticks, lice, or scab, a dipping vat is necessary. It should be so constructed in connection with the corrals that the greatest use can be had with the least inconvenience. Generally speaking, it does not pay every producer to make improvements individually. In communities of small producers who operate on the same or adjacent ranges, cooperative plants may be built by each contributing a pro-rata share of the cost and labor expenditure on the basis of cattle ownership. In choosing a location for such a plant, that most convenient to the greatest number of cattle should be selected.

Ranch improvements intended to facilitate the handling of cattle should include "traps" or small pastures adjoining or near the corrals or at other places where cattle are usually held. Traps need not be kept closed as separate pastures, but may be thrown open at times when they are not being used for holding purposes and the benefit of the grazing obtained. Traps are especially convenient when cattle are to be graded or a herd is to be held overnight; and their use will result in a great saving of labor necessary in making a round-up in large pastures and in the prevention of damage to cattle from horning each other, which often occurs when they are crowded in corrals. A variety of uses may be made of them, and the convenience is usually worth many times the cost of construction.

#### SADDLE HORSES

Of special importance in connection with a ranching establishment, from the standpoint of investment as well as use, are saddle horses

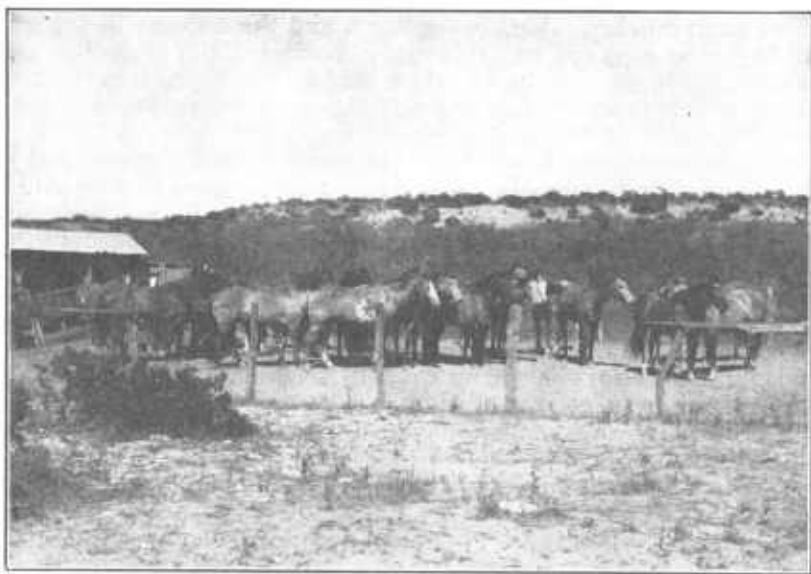


FIGURE 8.—Good type of saddle horses used in the southern Great Plains.

(fig. 8) and saddle-horse equipment. Most of the larger concerns raise practically all their own saddle horses, and in some instances a revenue is returned from the investment through sales of the surplus. But the production of horses is not considered a source of revenue so much as a matter of economy in supplying the needs of the ranch. Well-bred horses of even temperament are generally desired by ranchmen. Some highly bred horses are too spirited and fractious to be of the best service as ranch saddle horses. Care must be used in the selection of the stallion for producing cow horses. The tendency has been to use well-bred stallions on native or grade mares, and in this manner some fairly well-bred herds of range horses have been established.

Desirable weights for cow horses vary in different sections. Few cattlemen want horses that weigh less than 900 pounds or more than

1,100 pounds. Desirable characteristics for horses in the southern areas are: 950 to 1,050 pounds' weight; 14-2 to 15-2 hands high; good-proportioned, active, and energetic, but not of excitable temperament; good eyesight; short, well-muscled back; good, flat bone; broad, clean hocks; tough hoofs; endurance and sure-footedness. In the northern areas horses that weigh from 1,150 to 1,350 pounds are more commonly used.

Highly gaited horses are tiresome to ride for hours at a time, as is often necessary in handling cattle; and the preference is usually for the horse with a good walk, steady trot, and gallop rather than fast and fancy gaits.

Cow horses may be broken to ride at 3 years of age. The work should be very light the first year. In fact, the use at that age should be more for the purpose of gentling. The work of a 4-year-old may be harder, and training may be begun. Patience and ability are required in breaking a horse of objectionable habits and at the same time training him for the work for which he is to be used. Some horses learn quickly, others never learn, and those that will not learn had better be replaced by others more desirable. Horses that show the most intelligence and best action may be developed into "cutting" horses, which is about the highest degree of education for a cow horse.

The number of cow horses per man varies with the season and the amount of riding done. In areas where winter work is done and on relatively large outfits from 3 to 5 horses are allotted each man. These horses are usually fed hay and grain. On large outfits in the spring and summer seasons each man is provided with from 8 to 12 horses. Where the grass is strong enough to keep a horse in good condition with a half day's use each 4 or 5 days it is seldom necessary to provide them with additional feed. It is often advisable to condition horses for the spring work by feeding, unless they come in from the range in good condition.

In the earlier days of the range-cattle industry it was customary for each laborer or "cow hand" to furnish his own "outfit", which consisted of such equipment as saddle, bridle, blanket, and bedding, but in many instances at present the employer furnishes the equipment. A cheap quality of equipment is false economy, particularly when it may result in the ruining of a horse's back or other damage that would impair efficient use. It is far better to pay a higher price and select saddles that are shaped to fit a horse's back, comfortable to the rider, well-balanced in weight, devoid of flanky leather, and rigged for service. Well-trained horses and good equipment kept in proper condition may add to the initial investment or immediate cost of operation, but will decrease the expense in the long run.

#### CARRYING CAPACITY AND IMPROVEMENT OF RANGES

Competent State authorities have estimated the condition of native ranges, due to deterioration, at from 10 to 50 percent of their original productivity. Such deterioration is generally attributed to overstocking. Failure to consider this phase in its true importance is not only evident in the deterioration of range but is reflected in many instances in the size of the cattle produced, even where herds

of well-bred cattle, so far as blood lines are concerned, are maintained.

The temptation to overstock during years of good prices is one of the most difficult things a cattleman of the western ranges has to overcome. There is a tendency among many to stock heavily during good years to recover losses sustained during bad years, and the usual result is that the gamble is carried 1 year too far and a repetition of loss occurs generally about the time previous losses are recovered. Conservative cattlemen, and they are the ones who have developed the industry to its present high standard and acquired greater success in the range area, have learned to approximate the capacity of their respective properties and allow sufficient margin in their operation plans to meet the crisis of adverse or slightly subnormal years. In the event of extremely good years other stock is purchased and held for a period during which the growth or increase in value is generally little, if any, above a fair valuation of pasture rental, but is a means of efficient range use. Unfortunately, an attempt at complete utilization of all the vegetation, with resultant depreciation of the stand and vigor of the more palatable plants, was practiced by many stockmen on both private lands and uncontrolled public domain for many years.

The many varying factors affecting carrying capacity and the extensive areas of little or no grazing value make it doubtful whether any definite figures can be given which will apply consistently throughout regions as a whole or even throughout areas where the annual precipitation is approximately the same. A representative example of wide variation in carrying capacity of ranges is furnished on the Jornada Range Reserve in New Mexico. On an area of 200,000 acres, where the rainfall is approximately the same, the carrying capacity for individual areas varies as much as from 25 acres per cow per year on one area to 125 acres on another area.

The range map (fig. 9) is compiled from estimates, and in considering the number of acres per cow one must not lose sight of the fact that the length of the grazing season is a matter of great importance. Summer ranges must of necessity be supplemented with winter ranges or winter feed, for which provision must be made. When winter range is reserved the number of acres necessary to carry a cow for a year will be materially increased, and in the event of winter feeding the amount of farming land will be a matter for consideration. The most widely practiced plan is a combination of the two, as previously stated.

Many stockmen, when they consider range improvement, think first of artificial reseeding. Investigations on the typical range areas of the West have definitely shown that natural revegetation is generally more practicable than artificial reseeding. The first essential of range improvement through natural revegetation is to limit the number of stock to approximately the proper carrying capacity. Secondly, the range should be so grazed as to give a high percentage of the palatable vegetation an opportunity to reach maturity.

By deferring grazing until after the vegetation has made a good start and has either produced seed or revegetated by other means (fig. 10), the improvement has been as satisfactory as under total exclusion from grazing, except on areas where the range had become

so seriously depleted that the palatable forage plants were near extinction. It is not always possible to defer grazing over an entire range or unit; and the theory of the deferred and rotation system of grazing was worked out so as to obtain full use of all the forage throughout the year or season, to take care of the stock at the same time, and to allow improvement of successive parts of the range.

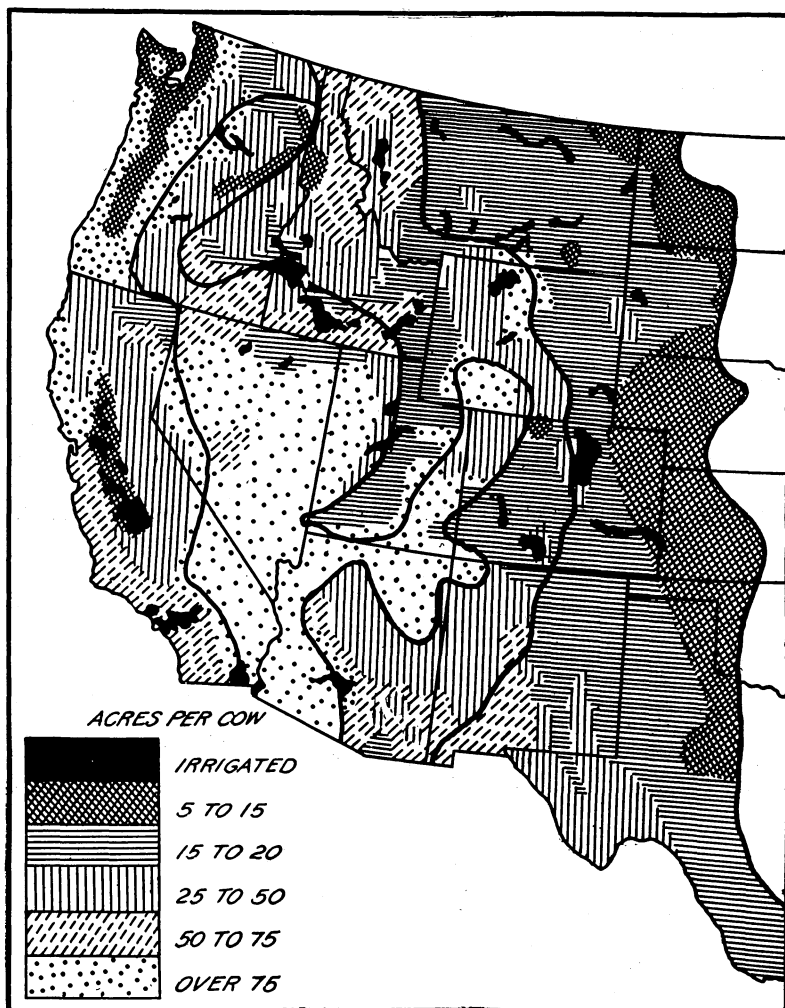


FIGURE 9.—Carrying capacity of the ranges of the regions designated in figure 1. (Adapted from data compiled by Forest Service and Bureau of Agricultural Economics, Department of Agriculture, and General Land Office, Department of the Interior.) The usual feed requirement for wintering and overcoming drought conditions should be considered in connection with the acreage shown above.

To apply the deferred and rotation system of grazing the range should be divided into several pastures of equal holding capacity according to varieties of forage, so that one or more pastures can be maturing while the others are being grazed. In the course of grazing, seed enough will be trampled into the soil to produce a new

stand. Three-year rotations may be used by dividing the range into three areas. Where the range is badly depleted, pastures may be deferred for 2 years in succession with better results than on a 1-year basis, but the time required to subject each entire range to some improvement will be doubled. Systems of this kind can usually be worked out on private lands and ranges. Selective grazing is a system that permits the use of the range throughout the growing season. This system, applied with a maximum rate of stocking to permit a reserve of 10 to 15 percent of the old grass on the range at the beginning of spring, is held in higher favor by practical stockmen than any other plan of range improvement and conserva-



FIGURE 10.—A pasture adjoining a forest range in southwestern Colorado that is used to a limited degree for early spring grazing but is closely grazed by the beef herd when being held during the fall round-up season and by the breeding herd at the close of the forest-grazing season. In this instance deferred grazing has permitted an abundant reseeding of native forage plants.

tion yet advocated. The need for range improvement is evident in practically every community, and is equal in importance to most production problems, if not more important.

#### SELECTION OF BREEDING COWS

To attain a first-class breeding herd after having begun the cattle business with inferior breeding cows requires several years' constructive breeding with good bulls. It is usually advantageous to begin with good young cows rather than to sacrifice the time required in breeding up from "tailings" or "cut-backs" from some other herd, even though the purchase price is from 10 to 15 percent greater. Usually a good method of obtaining breeding cows is to purchase



one or more herds that will supply the desired number after the better individuals have been topped out and the inferior ones disposed of. In some instances, however, it is to the purchaser's advantage to pay the higher price and take only the desirable ones. The more advantageous proposition will in each case depend on the prices asked, the percentage of desirable cows and heifers that can be obtained by buying the entire herd, and ability to dispose of the remainder. A system practiced by some producers going into business is to purchase the heifer-calf crops from one or more well-bred herds and mature them into breeding cows. The time required to mature them into breeding cows is the undesirable feature. Steers are usually handled also until the heifers become of breeding age.

The selection of cows for the breeding herd (fig. 11) is a matter of much importance, since it is from this source that the producer expects his returns. The real ability of a cattleman is brought to

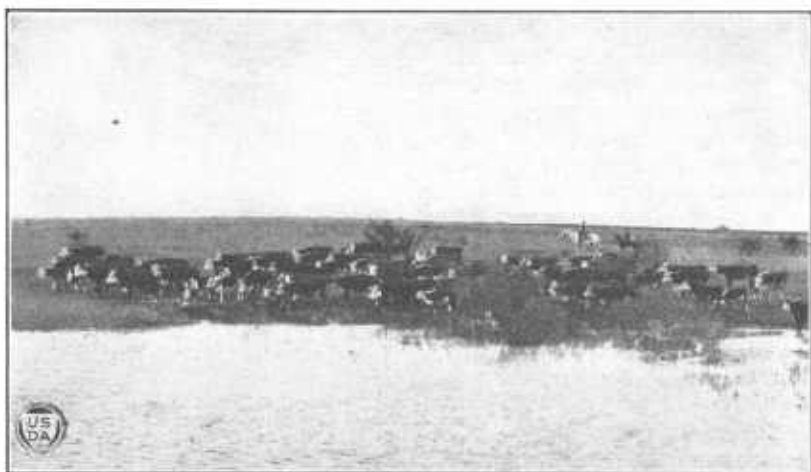


FIGURE 11.—A herd of well-bred range cows in western Texas.

test in selecting and maintaining a well-bred and uniform herd of breeding cows and the proper bulls. Successful breeding is measured in a high percentage of uniform and growthy calves of good conformation. Uniformity of color adds much to the appearance of range cattle and is desired by range men. A range cow should have a short head and neck; a straight, strong back; great depth of body; and well-sprung ribs, indicating capacity, clean bone, and a desirable amount of natural flesh; a sound udder; the ability to produce milk enough to raise a growthy calf; and rustling qualities, since range cows must necessarily travel over large areas for their feed. Regularity in calving, which is an influencing factor in the calf crop, is of such importance that shy breeders and other inferior cows should be shipped out or disposed of locally at such times as they will bring the most profitable returns. They should be replaced with the best heifers, preferably of one's own raising, if a desirable quality of cattle is to be produced.

## SELECTION OF RANGE BULLS

There are few producers in the range area who are not aware of the greater returns to be derived from the use of good bulls. The matter is so important that legislation compelling the use of certain grades of bulls on the range should not be necessary.

Experience has taught range men that bulls not accustomed to rustling their own feed to a great extent will not do well on scant range where no feed is supplied except during the winter. Therefore much emphasis is placed on the rustling qualities, and for that reason discrimination is often made against bulls that have been highly fitted or pampered.

In many sections of the range area there is a tendency toward lightness of bone in range cattle; particularly is this true in the southern portions of the Great Plains and Intermountain regions. Where that condition prevails special attention should be given to the choice of a bull with dense, clean bone, but not dense to the point of coarseness or clean to the point of extreme refinement. If the cow herd is extremely light in bone, more bone may be permitted in the bull than is ordinarily desirable if the cow herd is normal in that respect. A short head and neck with pronounced crest are wholly desirable. Masculinity should be so pronounced that there will be no mistaking the mature bull for a steer when he is viewed from a distance of several hundred yards. A straight, strong, well-fleshed back and well-developed hind quarters are desirable. The body should be reasonably deep and wide, showing capacity and constitution. Flat-ribbed individuals should be avoided. The legs should be strong and straight. Long-legged bulls are undesirable, and so are bulls whose legs are so short that they cannot travel over the range and gather their feed and serve the cows.

In selecting range bulls (fig. 12) extremes should be avoided, but extra efforts are well worth while to obtain individuals that are well balanced or "good from one end to the other." Range men insist on the use of bulls and cows of more scale and weight than is ordinarily seen in the same classes of cattle in the Corn Belt, as exemplified in the show ring, and consider this type, known as the "range type", as most efficient for their needs. Bulls so heavy that their activity is lessened or so light as to be undersized, are undesirable and should be avoided. The type of range is an influencing factor in the weight of bulls, since heavier bulls can be used in the Great Plains than under ordinary mountain-region conditions. Heavy bulls on a range where there is much sharp rock become tender footed. This condition impairs their usefulness.

Registered bulls are desirable, although it is not always true that registered bulls give satisfactory results. A recorded pedigree is worth little for a range bull unless the bull is an exceptionally good individual and sires outstandingly good calves, in which event it is usually profitable to select outstandingly good or practically pure-bred cows for the purpose of producing replacement heifers. Such instances are exceptions rather than the rule, and bulls of this class can often be used to advantage in a registered herd. In grade herds the use of registered bulls of the same line of breeding is being prac-

ticed as a means of fixing a desirable type in stocker and feeder cattle.

In communities of small producers where the number of bulls produced is not sufficient to supply the demand, it is often advisable for the cattlemen to purchase in carlots. Such a plan saves money, as a better price can usually be had on a carlot than on a purchase of a few head. If proper care is given bulls their period of usefulness may be longer than 3 years, and instead of having to dispose of an otherwise good bull to prevent possible crossing with his own offspring, exchanges may be made between producers who operate on ranges so situated with regard to each other that there is little probability that the bulls will stray back to their former ranges.

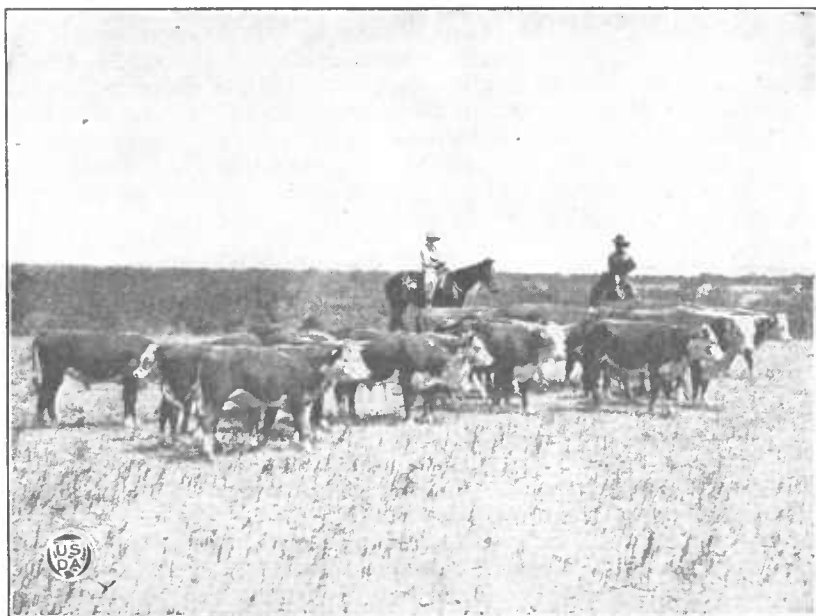


FIGURE 12.—Young purebred bulls of desirable range type.

#### MANAGEMENT OF THE BREEDING HERD

The method of management of the breeding herd depends largely on the class of range, whether fenced or unfenced, on which the producer is operating. Generally speaking, winter calving should be avoided because of the probability of loss of young calves and weak cows when subjected to unfavorable weather. Especially should winter calving be avoided where facilities do not include an abundance of winter feed as well as shelter from severe cold. The proper time for calves to be dropped is when there is sufficient vegetation for the cow to get her fill by grazing over the usual amount of range, other things being equal. That time varies within the different sections, and some years good grass is available earlier than others. For instance, if calves are not desired before April 15, bulls should not be turned into the cow herd before June 25, which allows 10 days for

the bulls to become accustomed to the new surroundings. Where sufficient cheap feed is produced and can be supplied to the cows rather liberally, calves may be dropped earlier, and the extra growth of the calves will usually offset to a great extent, if not entirely, the extra cost of wintering. During a period of years, however, a producer who follows this method may expect an occasional late grazing season, the results of which may be reflected in lack of growth of the calves, due to shortage of grass on the range.

Late calving is also conducive to winter losses and to an increase in the cost of wintering, not only in feed consumption but also in providing additional pens or feeding space. Cows that are suckling calves during the winter become much weaker than dry cows unless more feed is supplied, and if allowed in corrals with stronger cattle the probability is that they will not get the amount of feed intended for them. They may also be knocked down and trampled by stronger cows, and the result may be a total loss, or at least a source of trouble in getting them back to former condition. To avoid having calves dropped after August 1 the bulls must be taken out of the cow herd by October 20. In areas where rainfall is uncertain during the spring and summer months, it is usually advisable to allow bulls in the cow herd during all except possibly the winter season. In areas where screwworms are a serious problem some cattlemen control breeding so as to avoid having calves dropped during the worst months. Exact dates need not be followed in controlling breeding, but approximate dates to fit in with cattle operations will prove satisfactory. For instance, a forest-permit holder may use the dates of his cattle going on and coming off the forest range as desirable times of turning bulls with and taking them away from the breeding cows. Producers who operate on the range may select dates to coincide with dates of working the range. They should ride the range thoroughly during the breeding season to keep the bulls well distributed among the cows. Under pasture conditions it is not so difficult to control breeding, as the cattle are near at hand, although it may require some extra labor. In any event the practicability of controlling breeding should be considered. Ordinarily the decrease of the losses of both cows and calves, the high percentage of calves, the added value to the offspring due to the uniformity of age, and the possible decrease in cost of wintering will more than pay for the extra labor expense.

#### NUMBER OF COWS PER BULL

An increase in the calf crop, improvement in quality, and decrease in the depreciation of the breeding herd are among the means by which cattlemen can place their business on a more profitable basis. The most important factors that must be considered in the allotment of the number of cows per bull are the age and condition of the bull, and the class of range, whether broken, brushy, or plains. Bulls to be turned on the range should be at least 2 years old. Younger bulls may be used in small pastures where there are no old bulls, with not more than 10 to 15 cows allotted to each. In the Great Plains region the usual allotment is 1 bull to 25 cows, while on the extremely rough and brush ranges in the southern portion of the Intermountain region 1 bull to 15 cows is the usual allotment.

To increase the calf crop many of the successful producers in the range area advocate division of range, where possible, into pastures, each of which will carry 100 cows and an allotment of 4 thrifty, well-conditioned bulls. In normal years a 90-percent calf crop can be obtained if all the cows are good breeders. In pastures of 500-head carrying capacity, with the same ratio of bulls, a 75-percent calf crop can be obtained under normal range conditions. On unfenced ranges and where little extra attention is given to conditioning the bulls or culling the cow herd for shy breeders, the average calf crop will fall somewhat below 75 percent, according to available figures and opinions of cattlemen. If the greatest returns are expected from a cattle investment, efforts should be exerted to bring about conditions that are conducive to a high percentage of calves, such as selecting the best breeders, using the proper number and kind of bulls, maintaining cows in breeding condition, properly distributing bulls in the breeding herd, and segregating nonbreeding stock from breeding stock. Great emphasis should be laid on quality in the breeding herd and offspring, because of the keener demand for feeder cattle, especially of exceptional quality. Decreasing the depreciation in the breeding herd can probably best be attained by increasing the period of usefulness of bulls and increasing the market value of inferior cows, which in some cases may be done by selling them as fat cows instead of as canner cows.

#### HANDLING CATTLE ON THE RANGE

Rounding up or working the range is a time of great activity among cattle producers who operate on a large scale. In small pastures or on ranges bounded by natural barriers where cattle cannot become widely scattered the task need not involve excessive riding and labor, but where concerns operate over large, unfenced areas the labor and time required to ride the range closely is often very great. Many producers work the range twice a year, and it is not uncommon for those operating in the vicinity of each other to "throw in" or combine a part or all of their forces, depending on necessity, and work the range together. When this occurs the interests of each are looked after; that is, branding of calves and working cattle back to their own range. All the cattle that are to be taken off the range may be held together until the completion of the round-up, when each producer cuts out his cattle and drives them to another range or shipping point, as the case may be. In the southern areas, where the offspring are usually sold as calves and yearlings, the round-up may be begun at such a time that it will be completed near the date of delivery. If grass-fat cattle are to be shipped, the round-up may be timed so that the cattle will be held the least possible time after they are taken off the range, because considerable loss in weight occurs unless exceptionally good grazing is available for the beef shipment.

When the range is being worked the first time the breeding herd usually needs little attention other than to take out some undesirables, to drive strays back to their own ranges, and probably to move some of them to a more desirable range; but calves should be castrated, branded, (fig. 13), and marked. If corrals are close at hand, it may be more convenient to handle the cattle in them, but if far removed

from corrals, as is often the case on the open range, the entire herd may be held by several men and the calves roped out and brought near the spot where the branding irons are being heated. Branding without corrals is practiced less frequently each year and should be discouraged, since it is difficult work, as well as being hard on both stock and range.

When the range is worked the second time there is usually more handling of the cattle than at the first working, especially when the fat cattle are to be shipped, the breeding herd is to be shifted to the winter range or meadows for feeding, and the calves are to be taken away from the cows for weaning. In the mountain regions, where the forest range is used, the snow usually drives the cattle to lower altitudes, but care should be taken to see that the cattle do not become lodged in canyons or cut off from trails that lead to lower elevations free of snow.



FIGURE 13.—Branding calves on a Texas ranch.

#### CASTRATION

Bull calves should be castrated when from 3 to 4 months old. If castration is delayed until the calves are 6 months old or more they will in many instances annoy other cattle in the herd. If the operation is delayed too long, a crest begins to develop, the horns become larger at the base, and even after castration such individuals will be "staggy" in appearance, which is an objectionable characteristic. The operation may be performed by an experienced person without serious consequences, if common-sense rules of cleanliness are applied. The calf should be thrown and held firmly. The scrotum is stretched out tightly and about one-third of it removed by cutting squarely across with a clean, sharp knife. Force the testicles out of the end of the scrotum, grasp them one at a time, and pull them loose, or pull them out 3 or 4 inches and scrape the cords in two. The cords

should not be cut, as this method is conducive to greater bleeding. An écraseur, emasculator, or knife blade suitable for castrating may be used. Pockets in which blood can accumulate and form clots should not be left in the scrotum, but particular attention should be given to proper drainage. If there is danger of screwworm infestation, pine tar may be smeared about the wound and on the scrotum to keep flies away. Heifers may be spayed by one experienced in the operation. The losses from spaying are generally no greater than those resulting from castration.

Older bulls may be castrated in practically the same manner as calves, but more care should be exercised in severing the cord because greater bleeding is likely to occur. In no event should animals be driven or subjected to violent exercise immediately after castration, but they may be turned back to the range with only enough attention later to dispel screwworms if infestation occurs. After the wound has had time to scab over, a screwworm infestation may be detected by more or less swelling of the scrotum and evidences of fresh blood, which may or may not be an occasional drop. This applies also to calves with infested navels or any cattle with infestation at other places.

#### BRANDING

Before using a brand the operator should be certain that it has been recorded, as required by the branding laws of the State in which the range is located. As in the case of castration, the animal should be held firmly, and irons should be hot enough to run or stamp the brand with the least possible delay, but not so hot as to burn the hide. Scorching the hide to the degree that it will peel is all that is necessary. An application of linseed oil after the brand is run tends to soften the scorched area and probably prevents the formation of callous material often seen in brands made with extremely hot irons.

#### MARKING

Earmarks and dewlap marks may be of assistance in identifying or recognizing cattle on the range, especially if the cattle are wild and it is difficult to see the side which bears the brand. Earmarks are usually made by splitting the ear, in which case the mark is called a "split"; by cutting off squarely a small portion of the ear, a condition known as a "crop"; by removal of V-shaped portions of the upper or lower edge or tip of the ear, in which case the mark is called an "over bit", "under bit", or "swallow fork." Dewlap marks are made by cutting a strip of the hide on the dewlap in such a way that it will not grow to the former surface but will form a teatlike body. Wattles are sometimes cut on the lower jaw in a manner similar to dewlap marks.

#### WEANING

The calves may be weaned when from 7 to 9 months of age by separating them from the cows and confining them in pastures or corrals which should be so constructed as to prevent escape. Calves may be cut out of the cow herd and driven to the place where they are to be held; or conditions may necessitate driving the cows to a pasture or corral to cut out the calves, in which event it will be neces-

sary to drive the cows back to their range. In instances where cows have been driven in, it will be necessary to confine them out of sight and hearing of their calves for several days to keep them from coming back. Holding pastures assist materially in weaning.

Castration, branding, and marking may be completed at the time of weaning. If dehorning is practiced, the best time to do it is when the calves are small, since weather, condition of the cattle, and screw-worms are the principal matters to be considered in fixing the time of dehorning. Calves in good condition that are to be well cared for during the winter may be dehorned late in the fall; otherwise it may be well to wait until the following spring. Local conditions also have to be given due consideration. In the absence of a dehorning chute the calf may be thrown and held firmly. Care should be taken in removing the horn to take with it a strip of skin at least one-quarter inch wide and extending entirely around the horn. If there is danger of screwworm infestation, apply pine tar to the wound. If the weather is cold there will be no danger, the blood will coagulate, and a smooth poll will result if the horn has been removed properly.

The following spring the yearlings may be turned onto the range, but it is advisable to keep them on separate ranges or in different pastures from the breeding herd. Otherwise the heifers may "take up" and calve too young, and the steers, as a result of annoying cows in heat, may fail to make maximum gains. Owing to limited range or other facilities, it is sometimes impossible to divide the cattle into classes, but it should be done wherever practicable.

#### MATURING STEERS

In comparatively few instances steers are kept until maturity on the same range on which they graze as calves. This is especially true on southern ranges, which are generally referred to as "breeding grounds." Steers usually change ownership one or more times before they go to market as feeders or killers. Concerns that produce large numbers of cattle or have sufficient range to carry them, often purchase steers from other producers and mature them in addition to steers of their own raising. This method is often employed in utilizing surplus grass and making temporary cattle investments. Those who have been most successful in the matter of temporary investments have followed a policy of purchasing young growing cattle of desirable quality in most instances rather than aged steers, particularly on southern ranges where breeding herds are largely maintained. In this connection the quality of the range must be considered also, because the predominating vegetation on a desirable steer range must be good varieties of fattening grasses. Browse ranges can be utilized better by cows. Ranges of such altitude that the growing season is short, which also means a short breeding season and ordinarily results in a comparatively lower percentage of calves, are better ranges for steers than for breeding cows.

In the Great Plains region there are certain areas, notably the Osage ranges in Oklahoma, the Flint Hills pasture area in Kansas, and the bluestem, buffalo grass, and wheatgrass ranges in eastern Wyoming, Montana, and the western parts of the Dakotas, that are



considered especially adapted to fattening steers. The commercial trade in steers and the more desirable growth obtained when they are pastured on grass rather than on browse ranges have developed areas in which "aging" steers is the leading phase in the cattle business. The Panhandle of Texas, neighboring sections of lesser area in adjoining States, and, during recent years, certain sections of western Kansas, have become important in this activity. An abundance of roughage or good winter range is the requirement of a section in which to "age" steers. The usual custom of operators in such sections is to buy calves, yearlings, or 2-year-old steers from southern producers, hold them one or two grazing seasons, and sell them to steer buyers from the northern ranges. In fact, such areas as the Panhandle of Texas may be aptly termed concentration and distribution centers of feeder and stocker steers. In these areas the feeder and stocker buyers meet the owner on the range rather than the salesman of the commission concern on the feeder and stocker market.

Several years ago a high percentage of the older steers that left the southern ranges were shipped to Wyoming, Montana, and the Dakotas, but the increased expense of shipping and the settlement of areas of the range have curtailed this movement during the last few years. In many instances, however, pasturage is leased in some of the Northern States, and shipment is made to such pastures by southern dealers. In practically all instances southern dealers confine their shipment to northern ranges to steers 2 years old and over. Younger cattle usually go by outright purchase to northern buyers. During the last few years there has been an increase in the fall and late winter movements of calves, yearlings, and "short" 2-year-old steers into Kansas in particular, as compared with older cattle, especially during years of an abundant feed supply in that State. The older classes of cattle are usually roughed through the winter if brought in during the fall, but the younger ones are fed more liberally in order that a thrifty growing condition may be maintained.

The proper time for the movement of "aged" steers to northern ranges is in the spring, after the danger of extremely cold weather or blizzards has passed. They should not be moved, however, before the ranges are ready for grazing, unless provision is made for feeding. Under normal climatic and range conditions, about April 15 is the beginning of the movement from the southern to the northern ranges. In shipping from the southern to the the extreme northern ranges it becomes necessary to carry the steers through two grazing seasons and one winter, which means approximately 16 months on the northern range, in order that they may become acclimated, obtain sufficient growth, and fatten. Steers handled in this manner go to market as "long" 3's or 4's and ordinarily weigh from 1,150 to 1,250 pounds on the market. However, 3-year-old or older steers from the southern ranges can be fattened on the best pastures in Oklahoma and Kansas in one grazing season, provided, of course, that range conditions are favorable, and will reach the market weighing from 1,000 to 1,150 pounds. Southern dealers usually consider that the extra growth acquired in addition to the growth that would have been attained by the steers if left to mature on their native range is almost sufficient to bear the extra cost of shipping and handling. The northern steer buyer bases the price he can pay

on the probable gain and the margin between stocker and fat cattle, taking into consideration the quality of the cattle and expense of handling.

While steers are on grass they should be disturbed as little as possible, regardless of the region in which they are located. For this reason as well as others it is very desirable that operators on a certain range, whether forest or open range, cooperate in working or work the range at the same time in order that the cattle may be subjected to the least possible disturbance. Whips and dogs which tend to excite cattle should be discarded, and steer pastures should be closed to excessive travel or other intrusion.

Steers that are being matured on grass are fed cottonseed cake in addition to pasturage in some sections of Texas, especially when the price of cottonseed cake permits its use. If the pasture affords good grass in the fall and wintering seems reasonably cheap, the steers will be bought late in the fall and fed from 1 to 2 pounds of cottonseed cake a day during the winter. In the spring the amount of cake is increased from time to time, and by May 15 each steer receives from  $3\frac{1}{2}$  to 6 pounds daily. The use of the concentrate produces faster gains and better finish than grass alone, and this system of fattening has been very satisfactory in many instances. Steers consume only a limited amount of the cake at first, but after they learn to eat it will readily consume the allowance. Double-screened cake may be fed on the ground with little loss, or troughs may be constructed for the purpose.

Where several carloads of steers are being handled it is often advisable to make more than one shipment. Some steers fatten faster and acquire a suitable finish earlier than others on the same range, and such individuals may be "topped out" and shipped to market. Generally speaking, the first shipment of grass-fat steers from the range contains a rather high percentage of "soft" cattle. To obtain the best price on the market it is usually advisable to market well-finished cattle. While being driven to the shipping point, the steers should not be rushed or crowded, but allowed to travel slowly (fig. 14).

Ten miles a day is far enough to drive a beef herd; if the distance is 20 miles and across land that permits it, grazing may be done on the way. Arrangements should be made for watering en route. On drives that require several days the beef herd must be held at night or arrangements made for overnight pasturage.

Before shipment the steers should be graded, and those of uniform size and finish should be loaded, so far as possible, in the same car. A few steers that lack finish or quality, unless cut out and sold separately, will tend to lower the price of the entire lot. Steers that do not finish well enough to go on the fat-cattle market are usually sold as feeder steers (fig. 14), and years of subnormal range conditions generally mean a large supply of feeder cattle. Grading feeder cattle is as important as grading fat cattle.

#### SALTING ON THE RANGE

The quantity of salt that cattle consume on the range is governed to a great extent by the type of range. Browse ranges or other

coarse vegetation demand a more liberal allowance of salt than ranges on which the vegetation consists principally of grasses. Regardless of the kind of range, cattle should always have access to salt. It is well to make purchases on the basis of an allowance of 2 pounds per head per month for all cattle 1 year old and older.

The distribution of salt on a range is a matter of great importance. If a portion of the range is not being grazed so much as another portion, cattle may be brought to the less-grazed area by placing salt on it and removing the salt from the heavily grazed area for such time as one may see fit. Even with a system of fences the minor phases of control and distribution of cattle must be obtained through



FIGURE 14.—Watering feeder steers on way to shipping point.

salting. Salting away from water should be practiced to prevent overgrazing near watering places. The value of this practice has been thoroughly proved, and its more general use is a matter of much importance to range improvement. Placing salt in corrals has a tendency to make cattle gentle. Good salt boxes, large enough to hold a sufficient supply, pay for themselves in preventing waste.

#### HANDLING CATTLE IN WINTER

In practically all sections of the range area feed is required during the winter. The kinds of feed are determined usually by the varieties produced within the particular locality. Breeding cows should be wintered as cheaply as possible without interfering with their breeding capacity. However, the tendency, especially in the southern portions of the area, where rains do not occur until about July 1 or even later, to bring cows through in such poor condition that they do not recover in time to breed until late in the season, if at all, should be discouraged. Calves should be kept growing, and other

cattle should be maintained in such condition as to gain rapidly when placed on summer range. Protein feeds, at least in small quantity, are essential in most years to keep cattle in the desired condition on winter ranges. Feeding protein concentrates to stock on the range has been satisfactorily practiced in many instances in southern New Mexico and Arizona.

Generally speaking, the variety of available winter feeds is not large. On the northern ranges it is usually confined to native hay, alfalfa, and straw. One ton of alfalfa hay is usually considered sufficient to winter a mature beef animal; but in cases of shortage



FIGURE 15.—Winter range of this type furnishes excellent protection from cold winds. Generally speaking, there is not an abundance of grass on such ranges, but browse plants contribute to the grazing value of the range.

or extra-high price, half of the requirement may be replaced with grain straw, which is usually plentiful in the grain-raising sections. Racks should be constructed for hay if the cattle are to be fed in corrals.

The utilization of grain sorghums in southern areas where they can be produced offers an economical means of wintering cattle. Cheaper rations will ordinarily result if the heads are removed from the stalks and the latter put into the silo or fed as stover. At the Fort Hays branch of the Kansas Agricultural Experiment Station, Hays, Kans., a comparative test was made of the feeding value of an acre of kafir, with heads off and with heads on, both in the silo and in the shock. Yearling heifers were used, and results indicated that putting kafir, either with heads on or heads off, into the silo tremendously increased the value of feed from an acre. A ration composed of 30 pounds of kafir silage (heads off),  $3\frac{1}{2}$  pounds of straw, and 2 pounds of cottonseed cake produced an average daily

gain of 1.057 pounds during a 90-day period. An acre of kafir, heads off, more than doubled in feeding value when put into the silo instead of being fed as stover. The labor cost, however, should be considered in determining whether to put the headed kafir into the silo or feed it as stover.

In other sections there are feeds that may be used either regularly or in cases of emergency, chief of which are soapweed and prickly-pear, found in the southern portion of the Great Plains region. Another feed that promises to be important in northern sections is sunflower silage. Results reported in Montana Agricultural Experiment Station Bulletin No. 131, Growing and Feeding Sunflowers in Montana, indicate that "sunflower silage may be used as a winter feed for practically all classes of farm stock." The bulletin further states:

When digestible nutrients, yield per acre, and drought and frost-resisting qualities of the sunflower are compared with corn, it is readily seen that sunflowers have a distinct advantage over corn for silage purposes in the higher mountain valleys of the West or in other sections of the United States or Canada with similar climatic conditions.

In all the feeding experiments at that station clover, alfalfa, or mixed hay was fed with sunflower silage.

#### WINTERING BREEDING COWS

Mature cows should be allowed to graze on the range as long as they remain strong and in good flesh. Whenever practicable, the grazing farthest away from the watering places should be used first, as cattle may become too weak late in the winter to travel a long distance for water. When it becomes necessary, a maintenance ration, preferably of cheap roughages, should be supplied. From 10 to 12 pounds of roughage and 1 to 2 pounds of protein concentrates a day should carry cows through the winter in good condition. If hay alone is used, about 16 pounds of alfalfa daily will be sufficient, while 20 pounds or more of other hay may be required.

Where small grain is produced the straw can be used to cheapen the cost of wintering. In 3 years of experimental work carried on by the Montana Agricultural Experiment Station 1,100- to 1,200-pound grade Shorthorn and Hereford cows were wintered from 132 to 155 days on rations of straw alone, straw and hay, and straw and 1 pound of cottonseed meal per day. There was a loss in weight on all the rations. The results warranted the following conclusions:

After 2 months of grazing, there was neither any difference in the calves nor any difference in the cows that could be attributed to the winter rations.

Straw can be used as the only feed in the ration for mature breeding cattle in mild winters and when cattle are fat in the fall.

Straw supplemented with 5 pounds of hay per head per day wintered good, strong, beef cows satisfactorily and much better than did straw alone.

The difference in strength and condition between the cattle receiving 5 pounds of hay and 10 pounds of hay daily was not sufficient to warrant the heavier feed.

## WINTERING BREEDING BULLS

After the bulls are removed from the cow herd they should be held in pastures large enough and of suitable range to maintain them for a few weeks. When the range becomes short, sufficient feed should be supplied, at first, for maintenance; later it should be increased in such amounts that when the bulls go to the range in the spring they will be in excellent breeding condition. When bulls are kept on the range or on scant rations during the winter, they are in such poor condition in the spring that they must rustle for a few months before they have strength enough for much service. Forcing bulls to condition themselves on the range results in a smaller number of cows being served during the entire season and a high percentage of summer or late calves; but if the bulls are not to go into the cow herd until fairly late in the season a separate pasture may be used for conditioning them in the spring after they have been maintained during the winter. A small quantity of grain, from 3 to 5 pounds per head per day, and from 25 to 30 pounds of good hay for the last 45 days of the winter, is a good ration for bulls that have wintered well up to the time of beginning the grain ration.

## WINTERING CALVES

When calves are weaned they should be fed liberally, because they make better use of their feed than when older. The quantity of feed required per pound of gain increases with age, beginning when the calf is born. The feed should be of the best quality available, and the youngest calves should have the best hay. In farming districts where oats or other small grain can be pastured in the winter, producers find it profitable to make use of such crops for grazing. In addition to grazing, feed should be supplied, a portion of which should be a protein concentrate. In the southern portions of the Great Plains and Intermountain regions, where pastures are often utilized for wintering, extra feed must be given to assure proper growth of calves. The feed may be hay of good quality, preferably alfalfa or grass hay of fine texture, supplemented with a protein concentrate or grain. Calves which are stunted, ordinarily do not recover fully from the effects of improper treatment.

Corrals are ordinarily used for holding calves during the winter feeding period, except on the southern ranges. The use of corrals or pastures must be determined with regard to climatic conditions and availability of suitable winter grazing.

## WINTERING STEERS AND HEIFERS

At the Department's Ardmore, S. Dak., field station, 2-year-old steers were wintered very satisfactorily for a period ranging from 142 to 182 days in the winters of 1929-30, 1930-31, 1931-32, and 1932-33 on an average of 2,190 pounds of sorgo fodder a head. Moreover, either 1,358 pounds of alfalfa hay with 679 pounds of oat straw or 2,850 pounds of corn silage with 713 pounds of oat straw proved nearly as satisfactory because the steers averaged 22 and 13

pounds of gain, respectively, on these rations, whereas those wintered on sorgo fodder averaged 46 pounds a head gain during the wintering period of the years these rations were fed.

It is not usually advisable to feed yearling steers and heifers so liberally as calves. Two-year-old steers must be wintered cheaply to insure profit in holding them until they are 3 years old. A ton of sorgo fodder or three-quarters of a ton of alfalfa hay and one-quarter of a ton of straw will winter 2-year-old steers satisfactorily. A 1,000-pound steer at 2 years of age is very desirable, but that weight is much above the average in most sections of the range area. If the steers come off the range in the fall fat enough, it may be more profitable to market them at that time. If they lack flesh for killing and the feeder demand is strong, it may be best to sell them as feeders; otherwise they may be fattened on harvested feeds when the amount of feed on hand is sufficient to finish the steers and feed the rest of the herd satisfactorily.



FIGURE 16.—Choice Shorthorn feeder calves produced in the Great Plains region.

Heifers that are due to calve the following spring may be considered as cows; since they have rarely attained full growth at that age the same ration for them as for cows means a more liberal allowance, which is usually utilized at a profit.

#### WINTER GRAZING

Where winter grazing is done in pastures and transportation facilities will permit, cottonseed, linseed, or peanut cake may be fed on pasture. For grown cattle from 1 to 2 pounds per head per day will ordinarily suffice, depending to a great extent on the condition of the range. The concentrate may be fed in troughs, but is more often fed on the ground. Waste should be avoided. Feed is generally distributed to the cattle every second day instead of being fed every day, particularly where several herds are being fed. Dividing large herds of cattle into smaller bunches may often be advisable, especially

where there are several classes. At any rate, weak and strong cattle should be separated.

Attempts to supply protein concentrates or other feed on the open range during the winter should be governed by the practicability of transportation or other factors of economy. Some conditions may permit storage, particularly of concentrated feed, at various points before the winter begins and supplying it to cattle during the worst periods. Browse range is desirable for wintering in sections having much snowfall, as browse plants are generally taller than grass and are not covered by snow. Cattlemen should acquaint themselves with the relative value of grasses for winter and summer grazing and attempt to utilize each during the season that will mean the greatest feed returns from its use. The amount of natural protection from severe weather should not be overlooked in considering a range for wintering purposes.

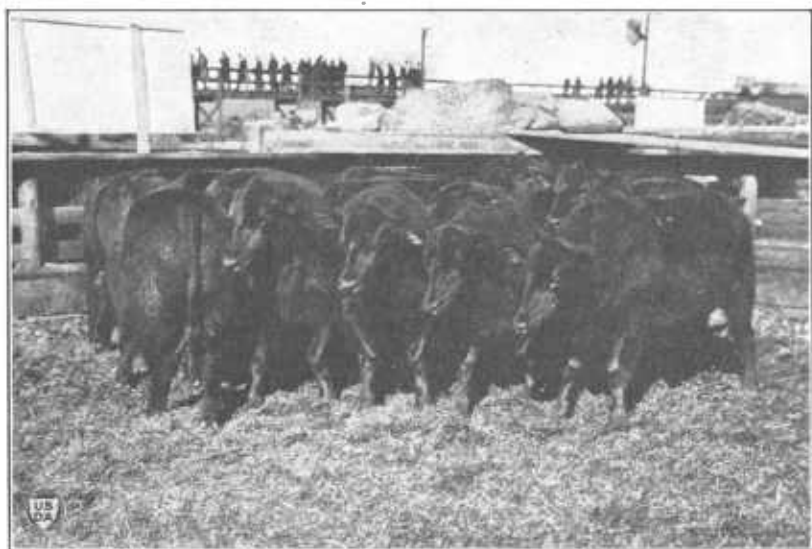


FIGURE 17.—Aberdeen Angus steers raised and fattened in the range area.

#### FEEDING FOR FATTENING

As compared with the number of cattle produced in the range area, the number fattened in the feed lots is small. Cattle feeders who produce neither feed nor cattle but purchase both take a long chance at making a profit, because the western markets are generally glutted with fat cattle in March and April and eastern markets are remote.

To those feeders who produce hay and purchase their cattle the question of class and condition arises, usually as to whether thin or half-fat cattle will be more profitable to feed. The feeder should take into account the amount of feed available, the margin of profit offered by each class, the probable market conditions, and the supply of "fed" cattle. He should not permit cattle which are to be fattened to lose flesh after they come from the range in the fall (fig. 17).



Valley or meadow pasture can often be utilized profitably at that time by the cattle that are to be fed, provided they are moved off when the best of the meadow is grazed. The feeding period is usually from 3 to 5 months, and if cattle are fed into the spring it may be expected that they will become restless. It will ordinarily be to the feeder's advantage to get the cattle on full feed at the earliest possible time, with due regard for the danger of their going off feed, and then give them all the feed they will clean up.

Fattening steers in the range area is generally confined to the irrigated farming communities. The production of sugar beets has stimulated cattle feeding in areas adjacent to sugar mills, as the use of manure helps to keep up soil fertility and the byproducts of sugar manufacture can be obtained in large quantities. Alfalfa hay is the



FIGURE 18.—A purebred herd on the range in the Great Plains region.

basis of most rations in the West, though in some areas where an especially good quality of native grass can be produced it is used instead of alfalfa. As such areas are usually small the production is limited. Silage is produced in comparatively small quantities. Wheat, barley, and oats are usually available for feeding, but the price often eliminates them from economical use. The use of protein concentrates is not general throughout the range area. Difficulties in transportation retard their use in many areas, and alfalfa is usually a cheaper source of protein in some areas.

To produce good gains in fattening steers requires animals that are thrifty individuals of a beef breed, gentle handling, comfortable feed-yard conditions, a good quality of feeds, and regular feeding.

In and near cotton-producing districts cottonseed products are used rather extensively, especially during years when such products are cheap and cattle-market conditions are encouraging. A rather

common practice is to feed in the vicinity of cottonseed-oil mills, thus reducing to the minimum the transportation charges on feed. The rations are commonly composed of cottonseed hulls and cottonseed meal, which are fed from 90 to 120 days.

#### THE PRODUCTION OF PUREBRED CATTLE

The tendency is toward the use of more registered bulls instead of grades for range purposes. The production of purebred beef cattle in the range area (fig. 18) affords producers of grade cattle an opportunity to procure desirable range bulls that have been raised under similar climatic conditions. Bulls moved to western ranges from the the Eastern States often require a year to become acclimated and during that time are of little service. The demand is usually greater for those raised under western conditions.

High-priced irrigated land may return a profit when it is used to produce purebred cattle. Purebreds may be produced in areas of good pastures in valleys which are so small that sufficient grade cattle cannot be handled profitably. The cost of purebred as compared with that of high-grade bulls has probably retarded the use of purebreds more than any other factor, since the outlay of money for the purchase of a carload or more of purebred bulls is an item to be considered, and some concerns would require several carloads to replace the grade bulls. However, the increased value with each successive generation in both the breeding cows in the herd and the calves produced by purebreds, as compared with those produced by grades, may offset the difference in the initial cost of the bulls.

Table 3, compiled from the 1930 census, shows the total number of registered purebred cattle of the beef breeds in 11 western States and in 6 other States lying along the one-hundredth meridian. Probably about 75 percent of the purebred cattle in these 6 States are produced in the eastern portions of the area, where farming is highly developed. In some instances less than 25 percent of the purebred cattle in a State may be produced in those portions of the State which are in the range area, but the average will differ only a little from the figure given.

TABLE 3.—Registered purebred cattle of the beef breeds in 11 Western States, and in 6 others along the one-hundredth meridian, April 1, 1930 (census)

State	Aberdeen Angus	Hereford	Polled Hereford	Polled Short-horn	Short-horn
Arizona.....		7,729	340	1	97
California.....	1,406	9,725	165	82	5,116
Colorado.....	974	23,352	99	83	6,891
Idaho.....	84	5,472	87	91	4,019
Montana.....	1,155	17,645	1,166	19	8,175
Nevada.....	5	2,391	8		978
New Mexico.....	72	18,899	33		140
Oregon.....	639	5,646	43	20	4,207
Utah.....	58	5,117	1	3	1,769
Washington.....	641	1,138	51	5	3,936
Wyoming.....	175	17,389	383	41	1,252
Kansas.....	2,673	42,442	1,371	1,324	23,522
Nebraska.....	2,692	42,166	1,184	2,502	16,778
North Dakota.....	2,159	8,098	130	128	15,723
Oklahoma.....	1,104	13,795	220	180	9,187
South Dakota.....	1,822	17,252	351	632	11,171
Texas.....	943	93,847	1,104	196	4,245

## REQUIREMENTS OF PUREBRED CATTLE FARM

The requirements for a location where purebred cattle are to be produced depend upon whether the breeder wishes to produce bulls especially for the range men or whether he expects to produce cattle of fashionable breeding and cater largely to the show-ring trade. For the former, excellent native pastures and facilities for producing a sufficient quantity of first-class hay and for producing or acquiring grain for feeding young growing stock and herd bulls are necessary. For the latter, conditions necessarily have to be along lines of a highly developed farm, which means in most cases a relatively high percentage of irrigated land. In either case fences should be well-constructed and the acreage divided into a sufficient number of pastures and fields in order that certain animals may be kept together. The construction of barns, particularly in the northern section, will demand special attention. An abundance of good water is essential.

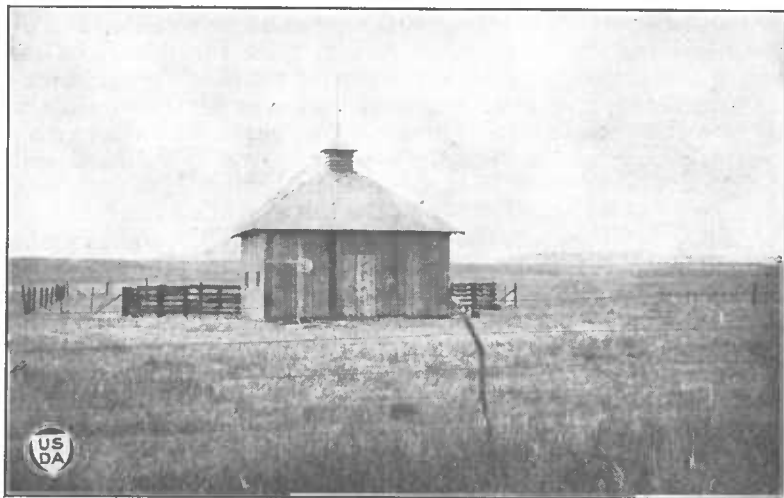


FIGURE 19.—A bull barn with pens conveniently located with respect to cow pastures offers an opportunity of proper care of herd bulls and control of breeding.

## CARE OF THE BREEDING HERD

The breeding cows should be kept in good breeding condition. A ration that will keep the cows thrifty is all that is necessary. In case of shortage of pasture it may be necessary to feed through the summer. Good alfalfa hay will often suffice, in amounts depending upon the grazing available.

During the winter 20 pounds of good alfalfa hay a day, or its equivalent, should maintain dry cows in good condition where shelter is furnished. In the northern sections during extremely cold weather the allowance may be increased, or grain may be added. In the southern sections 20 pounds of hay will ordinarily meet the requirements during the most inclement weather.

During periods other than the breeding season bulls may be maintained in good flesh, but conditioning should be begun at such time

that the bulls may be in excellent condition for breeding during the season of heavy service. If the bulls are grazing on poor pasture during the breeding season, hay should be supplied in addition to the allowance of grain. If the bulls are on good pasture, from 4 to 6 pounds of grain mixed with 1 pound of protein concentrate per 1,000 pounds live weight should be fed. During the winter 20 pounds of alfalfa hay or its equivalent of other hay and 5 pounds of grain per 1,000 pounds live weight will be a very satisfactory ration, if increased to meet the needs of conditioning for the breeding season by the addition of a protein concentrate.

#### CONTROL OF BREEDING

Purebred cows may be bred to calve at any time if provision is made for shelter during the winter. Lot breeding is a general method in small herds. Breeders who maintain cow herds large enough to require the use of several herd bulls generally practice pasture breeding. Pastures of sufficient size to furnish an abundance of grazing for the number of cows, 30 to 40 (occasionally 50 head), allotted to one bull are constructed and the bull turned onto the pasture with them. A record is kept of the cows bred to each bull where the registration is kept up. If this system is practiced each cow should be seen daily, the bull fed, and extra precaution taken that no other bull or cows get into the pasture.

Calves should be tattooed while still suckling to prevent any possible mistake in the record. When they are from 7 to 9 months old they should be weaned by being separated from their dams and confined in corrals or barns. If the calf is to be used for exhibition pur-

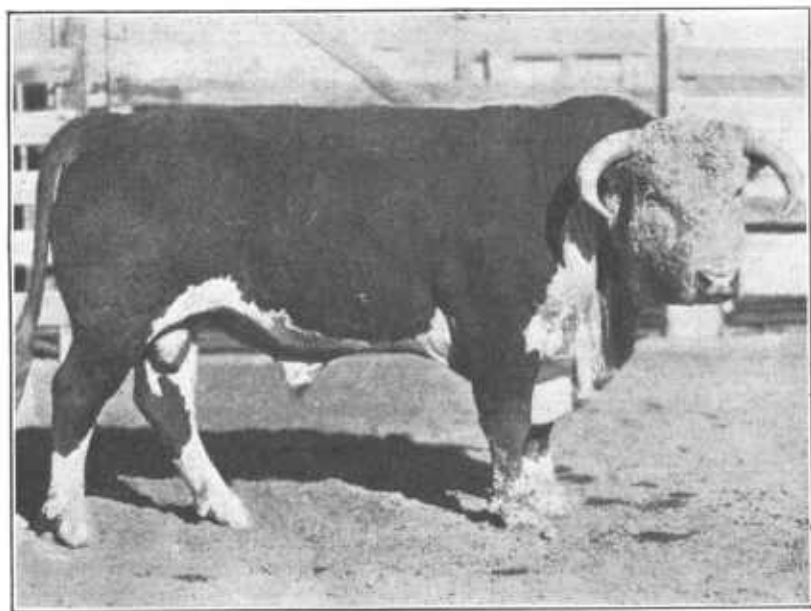


FIGURE 20.—A herd bull of this type is very desirable in producing range bulls. Note especially scale, depth of body, bone, and natural flesh.

poses closer attention should be given and a nurse cow, if necessary, supplied before weaning.

When cows are fed grain while suckling their calves, the latter usually learn to eat it; but if they are pasture-raised it will probably be difficult to get the calf started on feed which should be supplied liberally throughout the season of short pasture. Previous to weaning, inferior bull calves should be castrated, and the castrating knife should be used on others that do not develop into likely looking bulls. Grain is indispensable in putting proper growth on purebreds. If it is fed only during the first year it will have no effect on the "rustling" qualities of bulls to be used on the range. Specially promising bull calves should receive extra attention on account of the possibility that they may develop into bulls fit for registered herds. Unless the herd is of exceptional merit the possible herd bulls (fig. 20) will not be above 5 percent of all calves and more often between 2 and 3 percent.

A ration that should give good results when the young cattle are being developed is composed of equal parts by measure of corn, oats, and bran. If these feeds are not available, others may be substituted in proportion to their feeding value. A good quality hay should be supplied as needed.

Aside from feeding, the culling of the herd for inferior cows, the selection of new breeding stock, heifers and herd bulls, and the prevention of disease are the chief problems in herd management. One important point should be foremost in the business policy of every producer of purebred cattle—to produce cattle that will establish a regular trade, so that purchasers will be so thoroughly satisfied that they will return when they desire other breeding stock.

#### POISONOUS PLANTS OF THE CATTLE RANGE

The danger of cattle being poisoned by range plants varies considerably with different regions and with local conditions. Usually when other feed is abundant, losses from this source are not great, but at times conspicuous exceptions occur. Caution is therefore advisable. The plants vary in the different range areas and in the various portions of each area so that a knowledge of the poisonous species on the particular range being used is helpful to the stockmen using it. A discussion of all the plants that may cause trouble is beyond the scope of this bulletin. With some plant groups, closely related species may differ sufficiently in their poisonous qualities to make it difficult to know which of them are sources of danger to cattle.

Throughout much of the Great Plains region a few of the species or kinds of loco have caused very serious losses. With the breaking up into pastures of large portions of this region and the increased care being given to the management of cattle, losses from this source have been somewhat reduced. The most widely distributed of these plants is the white loco. However, the purple loco and certain closely related species cover nearly as much territory. Farther west, more particularly in portions of the Intermountain region, blue loco is very common and during some years causes serious losses.

Throughout a considerable portion of the higher mountain ranges of the Rocky Mountain region and to a less extent those of the Pacific Coast region, tall larkspurs frequently cause the poisoning of cattle, and in portions of the Great Plains the low-growing form of this plant is sometimes a source of trouble. Probably locoes and larkspurs play the major roles as poisons for range cattle.

Among other poisonous plants that are found on certain ranges, including several plants that are poisonous only at times, are water-hemlock, whorled milkweed, certain species of oak brush, Johnson grass, lupines, and several species of *Senecio*. The roots of water-hemlock are very poisonous to cattle. The plants grow in wet places in many parts of the United States. The whorled milkweed that is poisonous to cattle is the kind with narrow leaves, which is common in many areas in the southern portion of the Rocky Mountain and Intermountain regions. It is responsible for the deaths of a considerable number of animals. Certain species of oak brush, in periods when other feed is scarce and the animals are forced to live largely on them, cause many cases of illness and death. On some ranges of the southern portion of the various regions Johnson grass, particularly in periods of drought, may produce prussic acid in sufficiently large quantities to become a source of danger for cattle. Lupines are primarily a sheep poison; however, some of them in portions of the mountain areas kill a number of cattle. The symptoms in these animals are very similar to those of larkspur poisoning. Several poisonous species of *Senecio* are becoming abundant on some ranges, and although cattle losses from them are not numerous they appear to be a source of considerable danger. Recently several plants that under some conditions take up selenium from the soil have been suspected as causing losses. At present their importance in this respect is not definitely known.

Methods of treating animals that have been poisoned by a few plant species have been recommended. Among these plants are loco, larkspur, and those that produce hydrocyanic acid. As a general principle, however, it is far better to find means of preventing animals from eating the poisonous plants than to treat them after they have been poisoned.

#### CATTLE PARASITES IN THE RANGE AREA

The most common parasites affecting range cattle are ticks, lice, and scab mites.

Spinose ear ticks are prevalent in some of the southern portions of the Great Plains region and very generally in the arid sections of the Intermountain region. An infested animal usually shakes its head, holds it to one side or the other, and rubs it as if the ears itched. The ticks may be beyond detection by sight, in which case a smooth wire bent into a half-inch circle with an extension of from 6 to 8 inches as a handle, may be inserted into the ear and used to dislodge some of the ticks. Dipping is not effective, but a small amount of a mixture of 2 parts, by volume, of pine tar and 1 part of cottonseed oil, slightly heated if necessary to mix thoroughly, poured into the ear is very effective.

Other ticks found on cattle in the range area are: The Rocky Mountain spotted-fever tick (*Dermacentor andersoni*), the moose

tick (*D. albipictus*), the red-brown winter tick (*D. nigrolineatus*), the Pacific coast tick (*D. occidentalis*), and the western castor-bean tick (*Ixodes ricinus*, var. *californicus*).

The Rocky Mountain spotted-fever tick, the moose tick, and the Pacific coast tick have been shown to be capable of transmitting anaplasmosis, a disease of cattle, under experimental conditions.

In cases of scab, which may be detected by loss of hair from small areas at first but increasing from time to time, a competent veterinarian should be called. There are several kinds of scab, with varying degrees of seriousness, which demand different treatments, and one not specially qualified is hardly prepared to administer proper treatment.

Where cattle are handled occasionally it is usually of advantage to take the necessary time to examine for lice. It may develop that there are poor and unthrifty individuals in the herd, a condition which could have been avoided if lice had been detected in time. Dipping and spraying are effective remedies. The former is advocated for large herds, and the latter may be employed when herds are too small to justify the construction of a vat. Formulas and directions for making standard dips may be had free of charge from the Bureau of Animal Industry, United States Department of Agriculture.

#### DISEASES COMMON IN THE RANGE AREA

In all probability the most widespread disease in the range area is blackleg. It frequently affects young fat cattle, the resulting losses often being high. Preventive vaccination should be practiced by every producer, especially in areas where the disease is prevalent. Affected animals often develop a lameness; swellings may vary in size, some being as large as a saucer. They occur usually in the region of the hips or shoulders and on light tapping or feeling the swollen spot rattles or feels like paper.

Anthrax may also occur in some parts of the range area and may affect other animals as well as cattle. Early diagnosis and preventive vaccination are desirable to forestall undue loss.

Anaplasmosis has been found in some herds in the range area. This disease clinically resembles tick fever except that affected animals, as a general rule, do not show any evidence of bloody urine. There is a severe anemia and yellowish discoloration of the tissues. Recovered animals remain carriers of the disease for years and serve as a source of infection for the perpetuation of the disease in the herd. Anaplasmosis may be transmitted by carelessness in such operations as dehorning, castration, and vaccination.<sup>2</sup>

Bang's disease is another malady that affects cattle in the range area. Tests for this disease should be made from time to time if plans have not already been made to test all cattle in the area, in cooperation with the various States and the Federal Government. All breeding stock purchased should be from disease-free herds or be tested and retested after 60 days and found free of disease before being added to the herd. Any aborting cows should be promptly separated from the rest of the herd and a blood test made to de-

<sup>2</sup> See Farmers' Bulletin 1600, Dehorning, Castrating, Branding, and Marking Beef Cattle.

termine whether the abortion is due to accidental cause or to infection.

Although the greater part of the range area has been practically freed of bovine tuberculosis, there is still danger from this disease in some areas where eradication is incomplete. The tuberculin test should be applied to animals in the breeding herd from time to time, and all breeding stock purchased from other herds should be free from tuberculosis as shown by the tuberculin test, or should be purchased from a breeder in an area which has been officially designated as a modified accredited area.

Other diseases are usually local in their occurrence. The best means of combating them in the range area is for cattlemen themselves to take an intense interest in the enforcement of the sanitary laws of their respective States; to set an example in range sanitation by destroying the carcasses of animals that die, preferably where they fall, as dragging carcasses often spreads disease; and to eliminate all conditions conducive to disease.

When infectious diseases occur among range animals the question of control should be a problem for the practicing veterinarian, as much as for the State livestock sanitary officials, cooperating with the cattle owners.

Department publications which discuss the diseases mentioned and other ailments that may be encountered are available upon application to the United States Department of Agriculture.